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Notes on the Lake Superior Copper Country

The greatest general interest in connection with exploratory work projected and underway in the Lake Superior copper country, probably attaches just now to the activity on the South range, that part of the district lying south of Portage Lake. In the group nearest to the town of Houghton are the Isle Royale, Houghton and Superior mines, in which the Isle Royale and the Baltic lodes are the objects of attack; the Isle Royale lode in the mine of that name, and the Baltic lode and its west vein in the other two.

The oldest of these mines is the Isle Royale, where of late years operations have been conducted through four shafts, Nos. 2, 4, 5 and 6. The lode extends diagonally across the property, in a northeast-southwest direction, the general trend of the Keweenaw copper series, and is opened at the northern end of the mine by No. 1 shaft, idle for some years. The most southerly working shaft, No. 6, is approximately two miles away to the southwest. Recently, owing to favorable underground developments at the southern end of the mine, and a desire to increase available tonnage as well as to explore, No. 7 shaft has been started at a point about one-half mile south of No. 6. The view shown in Fig. 1 was taken from a position a few feet south of No. 7 shaft, and looking northeast along the strike of the Isle Royale lode. In the foreground is seen the first set of timbers of the new shaft. The type of shaft construction here conforms to that employed at some of the Calumet & Hecla mines in the vicinity of Calumet, the manway being in the center of the shaft between the two skiproads. In the background are Isle Royale shafts Nos. 6, 5, 4, 2 and 1. The hills in the distance are on the north side of Portage Lake, about four miles from No. 7 shaft.

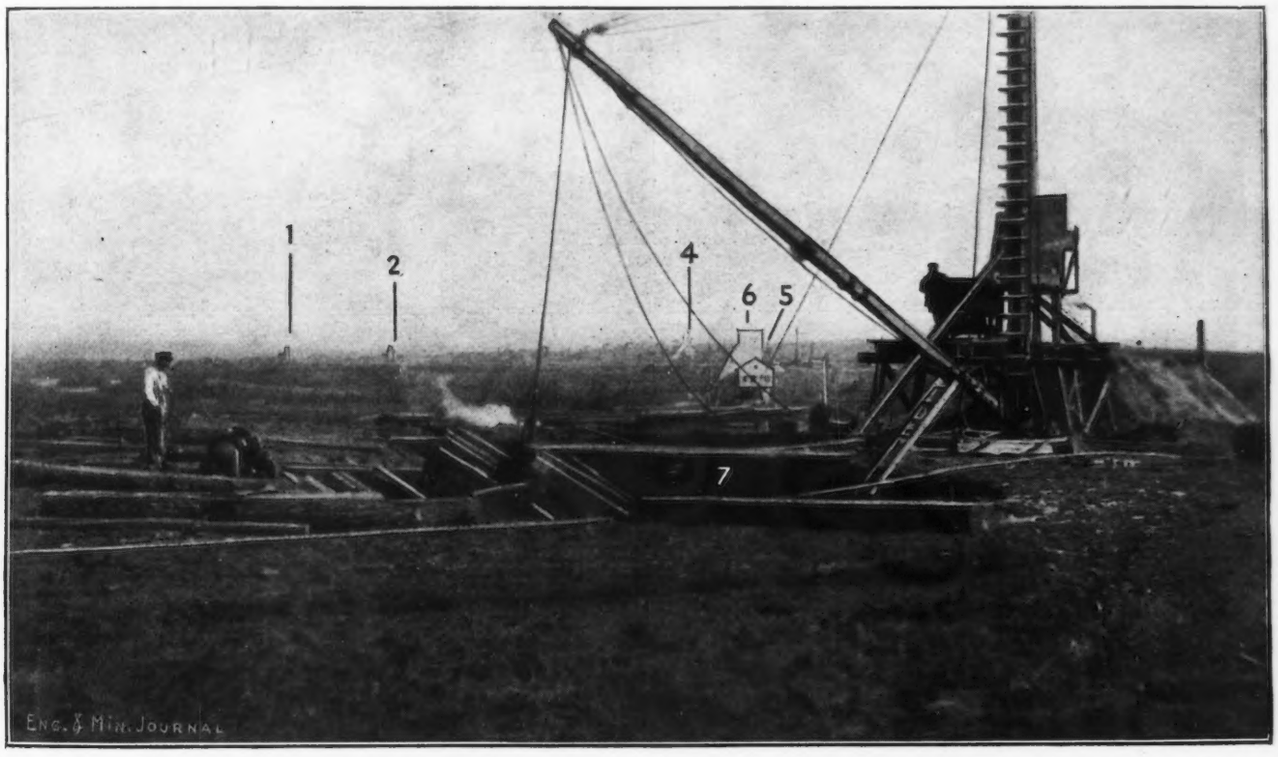


FIG. 1. ISLE ROYALE SHAFT NO. 7, WITH NOS. 1, 2, 4, 5 AND 6 IN BACKGROUND

Although the rock formation is covered with an overburden of drift varying in thickness from nothing to 110 ft., each shaft collar is situated either on the outcrop of the vein itself, as at the north end of the property, or on the surface of the overburden at a point representing the outcrop projected along the angle of dip.

The view brings out clearly the decided bend in the strike of the Isle Royale lode. This bend in the lode has been the subject of much speculation and figuring. In shafts Nos. 4 and 5, situated apparently near the point of maximum curvature, the lode was found to flatten somewhat at a rather shallow depth, and it finally became necessary to place a vertical curve in each shaft to bring the latter back to the lode.

The possibilities of this property are probably second to none in the district, as its width, meaning the distance within property lines at right angles to the strike of the formation, is such as to include the theoretical extension of the well known northern lodes, now being worked so successfully by the Ahmeek, Calumet & Hecla and Quincy, as well as the Baltic lode of the Copper Range company to the south.

The No. 1 Superior and the Houghton shafts are shown respectively in Figs. 2 and 3. The Houghton Copper Co. has a modern plant and is one of the first mining companies to utilize electric power from the local power company. The hoist is motor driven, through gears, and the compressor is operated by electric power transmitted by belt. This appears to be a satisfactory solution of the often knotty problem, a suitable, economical power plant for a shaft, whose primary object is exploration, with the possibility of actual mining later.

The Superior mine is largely responsible for the installation of the one-man rock drill, which now bids fair to supplant soon throughout the district the time-honored, two-man type. It was here also, that the "efficiency engineering" idea, as applied in the Lake copper country had its inception. This has achieved such importance with the Calumet & Hecla company, that its original sponser, Ocha Potter, superintendent of the Superior mine, has been appointed chief efficiency engineer of the parent company.

The energy that is being displayed in exploring virgin ground, improving methods and reducing costs in this district, encourage the belief that its best days are yet to come.

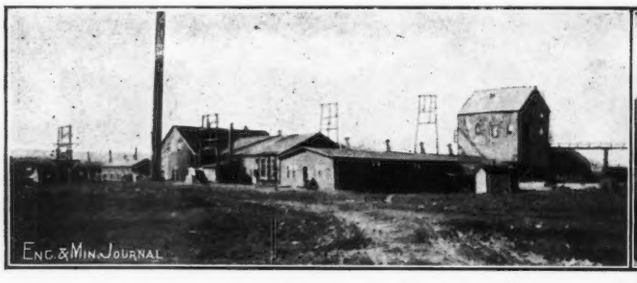


FIG. 2. SHAFT NO. 1 OF THE SUPERIOR MINE

FIG. 3. PLANT OF THE HOUGHTON COPPER CO.

Hedley Gold Mining Co.

The report of the Hedley Gold Mining Co. for the year ended Dec. 31, 1912, showed that the mill has treated 70,455 tons of ore carrying gold to the value of $788,715, on which the extraction was 95% or $748,133. Net profits for the year were $385,880, of which $360,000, or 30%, was paid in dividends. There were 1340 ft. of sinking, drifting and raising done during the year, besides 6380 ft. of diamond drilling. Development has been satisfactory and it is estimated that there is a minimum of 413,000 tons, averaging $11.35 per ton, in the Nickel Plate and Iron Duke claims. The usual reserve of 10,000 tons of broken ore is still carried in the stopes. Five mining claims of the Windfall roof were acquired at a cost of $145,913. This is the only expense during the year which was capitalized. All other expenses of every sort were charged to operating, including a new boiler, new diamond drill and new hoist. The cost per ton for mining and milling for the year has been reduced to 53c. and the total cost to 73c., although the mine is paying a higher rate of wages than in the years previous. In general, the state of the company is said to be most prosperous and the outlook good for a large increase in ore reserves during the coming year.

Diesel Engine vs. Steam Turbine

In a paper read by M. Gercke before a meeting of German electrical central-station managers and engineers at Kiel (abst. *Power,* Mar. 4. 1913), the following conclusions were formulated in regard to the availability of Diesel oil engines and steam turbines in central generating stations:

(1) For capacities of over 1000 hp. the initial capital outlay for a Diesel plant is higher than that required for a turbine plant of the same size. Hence the amount of interest and amortization per unit of output is also higher in the Diesel plant. These items, however, are of decisive importance only if the load factor of the station is low. For higher loads they drop out of the calculation. As far as the item of operating cost is concerned the Diesel engine is not to be recommended as an auxiliary. Only when the immediate readiness to start is a chief consideration is the Diesel engine superior.

(2) The cost of heat per unit capacity in Diesel engines is considerably lower than in steam turbines, provided the local price per 100,000 calories is 5c. or more, or if unfavorable water conditions prevent the utilization of the highest possible vacuum in the condenser of the turbine plant.

(3) With low load factors and low local fuel cost a steam turbine is the only mode of generation to be employed for large work, never a Diesel engine.

(4) With high load factor and high local fuel cost the case is reversed, a Diesel plant being more economical.

(5) The advantages of both types may in many cases be combined by installing Diesel engines and steam turbines together, the former taking care of the continuous load or part of it, and the latter of the peak loads, occurring during few hours of the day. This distribution commends itself on account of the lower initial cost of the steam turbine and of the possibility of augmenting the output of high-pressure boilers for some time. Quite a number of combined plants of this character are already in operation on the European continent.

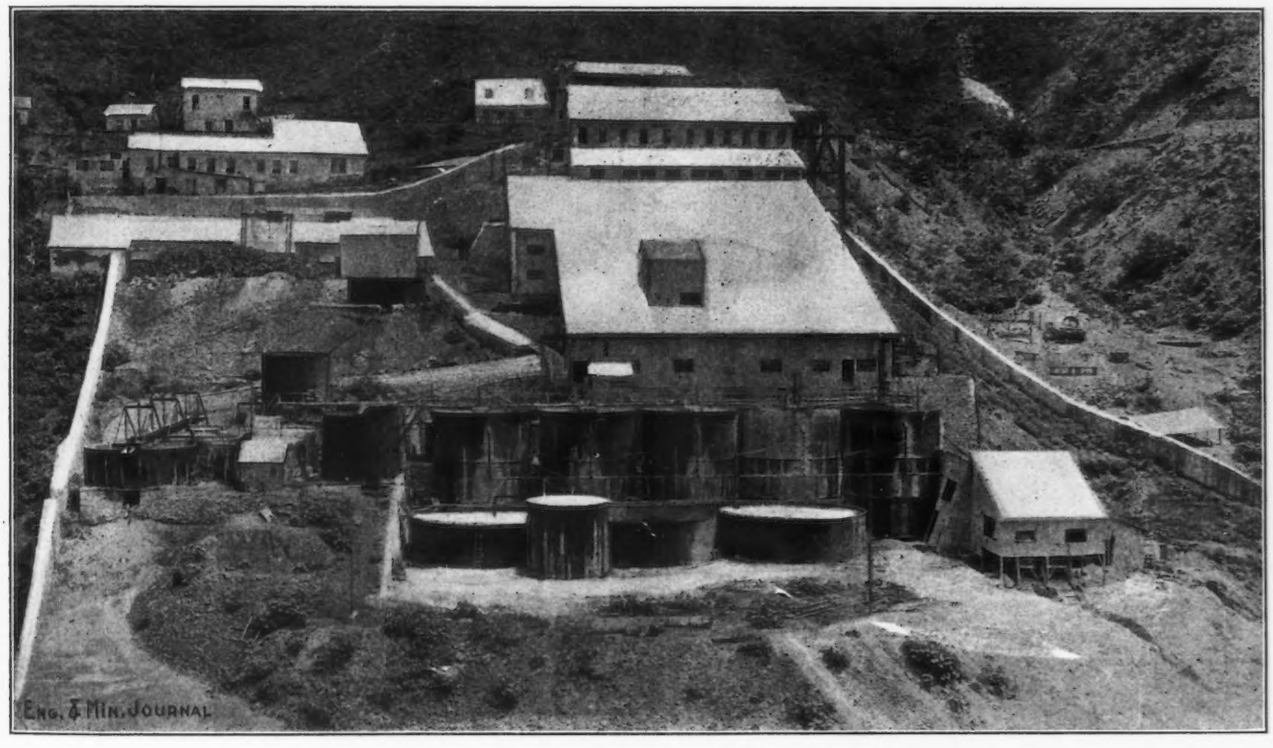
The Output or Ammonium Sulphate for 1912 is estimated by the "Iron and Coal Trades Review," Jan. 17, 1913, as follows: United States, 165,000 tons; Germany, 465,000; Great Britain, 379,000; France, 68,500; Belgium, 49,500; rest of Europe, 170,000 tons.

Improvements at Lluvia de Oro Mill

By H. R. Conklin*

SYNOPSIS—The gold and silver occur finely disseminated, necessitating fine grinding of the ore. Because of the extreme hardness of the ore, chilean mills following the Nissen stamps proved inadequate and tube mills were substituted, mine rock being used for pebbles. Amalgamation was abandoned as unnecessary. The charge system of agitation followed by filtration was changed to continuous cyanidation, employing agitating tanks and thickeners in series. The overflow solution from the first thickener only is precipitated. By changing the contact solution in each thickener better extraction is obtained than by lengthening the agitation period.

Lluvia de Oro mine, Lluvia de Oro, Chihuahua, Mex., is near the top of a mountain, and is unique in that no pumping of water is necessary, no timbering required, no hoisting as all ore moves downgrade instead of upgrade, and ventilation is perfect on account of opening on both sides of the mountain at different levels. All drilling is done by hand, the amount of ore to be extracted being too small for the reduced cost per ton of mining to repay the cost of equipment with power drills.



Lluvia de Oro Mill, at Lluvia de Oro, Chihuahua, Mexico

Small Amount of Ore But Grade High

The small amount of ore to be extracted, considered with the circumstance that it is all fairly high grade, accounts for many of the peculiarities of the design and construction of the equipment. The several individuals connected with the designing were generally influenced by the latter fact more strongly than by the former.

Several thousand tons of tailing from a small amalgamating and concentrating mill, situated near the river, had been stored for future cyanide treatment. This tailing assayed from $25 to $30 per ton, but the quantity was insufficient to pay for erecting a cyanide plant at its site, and it is, therefore, brought to the present mill on muleback in sacks, at a cost of $3.50 per ton. The tailing is dumped directly into an old grinding pan, which thoroughly mixes it with cyanide solution. The pulp then flows to the first concentrators, after passing a coarse screen to remove weeds, large pebbles or other trash.

The ore from the mine is extremely hard, and the gold and silver are so finely disseminated that satisfactory extraction requires grinding so that practically 95% will pass 200 mesh. The crushing and grinding portion of the mill is of suitable size to treat over 100 tons per day of ordinarily hard ore, but cannot treat over 80 tons per day of this kind.

A grizzly screen and crusher are placed at the drift mouth, with an ore bin and the loading terminal of a wire-rope tramway which carries the crushed ore to the mill bin. The plan of the mill and flow sheets of ore and solution, shown in the accompanying engraving, explain the entire process, and no description will be given except of improvements or details which have been developed here, and which, so far as I know, are not in common use. Every effort has been made to simplify the

*Manager, Lluvia de Oro Gold Mining Co., Lluvia de Oro, Chihuahua, Mex.

milling process wherever it could be done without decreasing the extraction. Amalgamation was discarded, since all metal which was caught in amalgamation, could be saved in the concentrate, and without lowering the extraction, we could save all the troubles of amalgamating, loss of mercury, retorting, and have half as many places to watch for "high grading."

Stamp Mortars Cast in Two Pieces

Twelve 1500-lb. Nissen stamps, with individual mortars, arranged in three groups of four each, each group driven by a 10-hp. motor, constitute the battery. The stamps drop at the rate of 105 per min., the height of drop being 8 in. The camshafts are extra heavy and none has broken. These stamps are excellent in every particular. Only one improvement has been made, the mortar liner is now cast in front and back halves instead of in one piece, making removal easier and increasing the life, as the back half wears about twice as rapidly as the front half.

The original construction had three Lane slow-speed mills following the stamps. These were not suitable for grinding such hard rock and were replaced by two 3½x 16-ft. tube mills. These tube mills were built sectionalized for muleback transportation, and have proved satisfactory in every way. Ribbed cast-iron liners of the "El Oro" style are used in all tube mills and are made in small enough sections to be packed on mules. The final form of the ribs as used here is shown in the accompanying engraving. No imported pebbles are used; mine rock of 6 to 10 in. diameter is sorted out at the grizzly above the crusher and sent to the mill for use in the tube mills. The ore is so hard that these rocks wear in the tube mills until they can hardly be distinguished from the imported flint pebbles. Spiral feeds are used on all tube mills.

Neither set of concentrators is satisfactory, but as both sets remove less than 1% of the mine ore as concentrate, they are made to serve the purpose. The upper concentrators should have been placed at proper elevation for their tailing to flow to the classifiers; the lower concentrators so that their tailing would flow to the thickeners, instead of requiring a lift at each place.

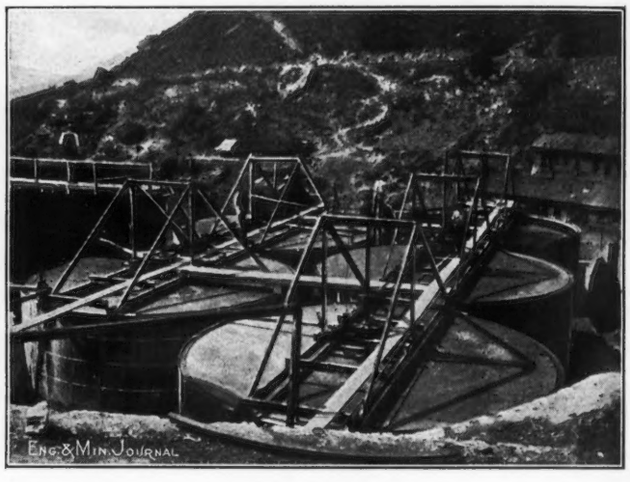
Cyanide Department

Protective alkalinity is kept between 0.8 and 1 lb. per ton of solution, as shown by titration of solution in the first agitating tank. This is just high enough to preserve good precipitation and not high enough to cause trouble by deposition in pipes and on filter cloths. An old grinding pan is used for a mixing tank; lime is slaked in a wooden box like a mason's mortar-mixing box, and the smoothly slaked lime is placed in the grinding pan, a few shovelfuls at a time and as frequently as required to keep the alkalinity constant. A small stream of solution continually enters the grinding pan and overflows into the thickening tank above the cyanide plant. The mine ore is alkaline instead of acid, and only a small amount of lime is needed.

The agitating tanks, 24x32 ft. in size, were planned for agitation by centrifugal pumps. This was immediately discarded on account of the excessive wear with ore which cuts like a sand blast, although finer than 200 mesh. These tanks have masonry hopper bottoms. Air agitation is used, and after trying all kinds of schemes for a central tube, similar to Pachuca practice, the inner tubes were laid to rest on the junk pile, and no machinery is used inside the tank except a 1½-in. pipe, open at the bottom end, and with hose connection at the top to permit of raising, lowering and shifting easily. The system of collecting in one tank, agitating and washing in charges, by decantation, and then filtering, was first operated.

Continuous Agitation and Thickening System

The present method is continuous agitation in four of the five tanks and continuous thickening and washing in five thickening tanks. No pulp has to be pumped, unless to empty a tank for repairs. The agitating tanks are piped for continuous agitation as described in the Engineering and Mining Journal of Mar. 23, 1912, p. 591. This piping is automatic, and any tank can be filled above its normal level by simply plugging its over-



Thickening and Washing Tanks at Lluvia de Oro Mill

flow slot. A day's run of the mill can be accumulated in four tanks by ceasing to agitate the last one, letting its charge settle, and decanting the clear solution from the top. Agitation is easily started by raising the air pipe and gradually lowering again as the charge becomes loosened. Four tanks are used, but nearly all of the gold and silver dissolved during agitation goes into solution in the first three tanks, the pulp in the fourth having practically the same undissolved precious-metal content as the pulp in the third.

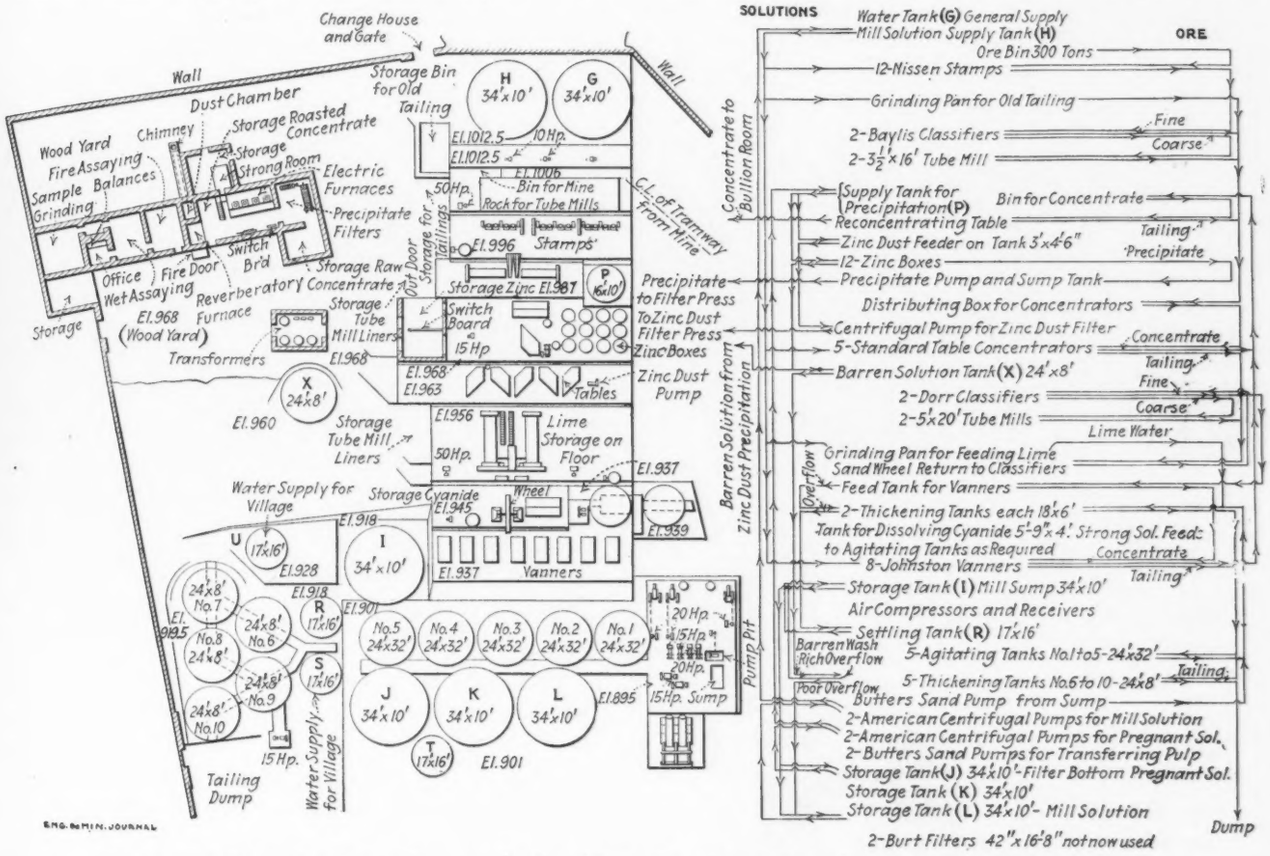
Five thickening tanks are used for washing, and are numbered from 6 to 10 inclusive on the mill plan. No. 6 takes its supply from the last agitating tank; its clear overflow goes to the gold-solution tank for precipitation, and its underflow of thickened pulp is mixed with barren solution and forms the supply for No. 7. Tanks numbered 7, 8, 9 and 10 overflow to mill sump, the solution being of low value and used for mill solution. Tanks are so connected, in piping the overflow, that in case of scant supply of barren solution as much as required of the overflow from Nos. 8, 9 and 10, can be used as a wash to supply No. 7, the necessary pressure for transferring the pulp being furnished by a centrifugal pump, driven by the same motor which drives the thickener arms. Thickened pulp, when going into tanks numbered 7, 8 and 9, is thoroughly mixed with barren-

solution washes. The pulp going into No. 10 is mixed with water wash. The thick underflow from No. 10 flows to waste.

These thickening tanks are all on the same level, for convenience in power supply, and at such level that the pulp overflow from tank No. 5, the last agitating tank, runs into the top of tank No. 6. A view of these thickening tanks is shown in the accompanying halftone.

One motor, with worm gearing on a countershaft, drives all the thickener arms, each tank having a worm gear exactly like that on the countershaft. Each worm gear has a speed ratio of 50:1, so that the motor speed of 1120 r.p.m. is satisfactorily reduced to a speed for the thickener arms of 1/8 r.p.m. When necessary to run the thickening tanks, and a nozzle of 1/4 in. diameter passes about 40 tons of solution per 24 hr., the higher head giving sufficient energy to transfer the thickened pulp from tank No. 9 to tank No. 10. In case the volume of solution in the entire mill increases too much, pulp can be transferred from No. 9 to No. 10 by compressed air, using the same 1/4-in. nozzle and about 10-lb. pressure, but the advantage of water wash is then lost, and pulp does not settle quickly after being so thoroughly mixed with air.

All thickening tanks have a cement-floored tunnel underneath, permitting easy access to valves and pipes. This tunnel drains to the sump in the pump room, so that when necessary to empty any tank, the transfer pipe is



PLAN AND FLOW SHEET OF LLUVIA DE ORO MILL, LLUVIA DE ORO, CHIHUAHUA, MEXICO

centrifugal pump for wash into No. 7 tank, it is belt driven from the countershaft, the placing or removing of this belt requiring only a few minutes.

EJECTORS FOR TRANSFERRING PULP

Our precipitation work is done on the same level as the refining, and barren solution flows into tank X. This tank is 35 to 40 ft. above the thickening tanks. A scheme was devised of using this head to transfer the thickened pulp from the bottom of each thickening tank to the top of the next in series, at the same time thoroughly mixing the wash solution with the thickened pulp. An ejector is placed below the thickening tank, with suitable nozzle for the wash solution. With the 35 ft. available head at this plant, the nozzle holes for wash solution are 5/8 in. diameter, and pass approximately 200 tons of solution per 24 hours.

Our water supply has a head of about 90 ft. above the disconnected and the tank emptied into the tunnel, the flow being regulated by the gate valve underneath the tank. Detail of the piping underneath the tanks is shown in the accompanying engraving.

Instead of an angle-iron ring for stiffening the top of these tanks, a Z-section is used, inside the tank, serving both for stiffening and as a launder, details of which are shown in an accompanying engraving. All these tanks and their bridge work were built of sheets and rolled sections small enough to be packed on muleback at no higher rate than regular freight. All rivets of 1/2 in. diameter and smaller were of soft steel and driven cold by hand.

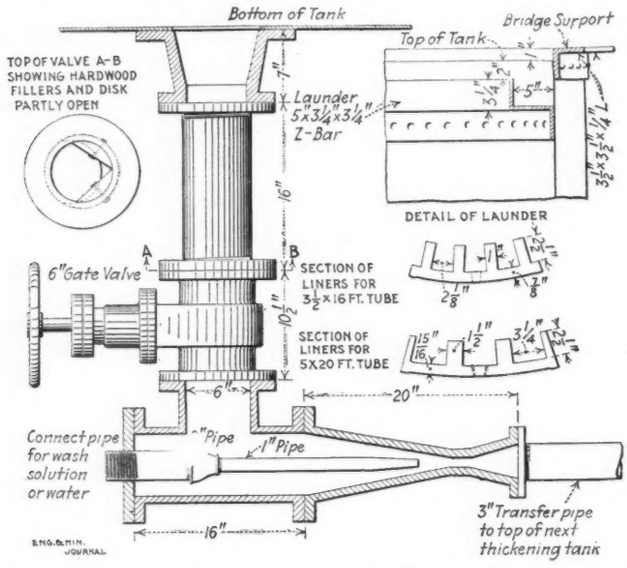
THICKENER ARMS INCLINED UPWARD FROM CENTER

The arms which revolve in the thickening tanks were not placed level, as in the Dorr thickener, but are inclined about four feet, the pulp settling hard underneath

the arms and forming a conical bottom. This gives much better results in power required, thicker pulp, and a deeper layer of thickened pulp above the discharge-regulating valve.

These discharge-regulating valves were first made on the style of a needle valve, but were not satisfactory, and are now made by bolting hard-wood filler pieces in a regular 6-in. valve, so that the shape of the opening is nearly triangular when the valve is slightly opened, and a small stream of thick pulp is not so liable to stop flowing.

An appreciable amount of the gold and silver is dissolved during the grinding of the ore in the mill. During the passage of the pulp through the agitating and thickening tanks, the rest of the dissolution occurs. Using four agitating tanks, samples of pulp from the third tank,


Bottom of Tank
Bridge Support
Top of Tank
TOP OF VALVE A-B SHOWING HARDWOOD FILLERS AND DISK PARTLY OPEN
Launder 5"x3¼"x¾" Z-Bar
DETAIL OF LAUNDER
6" Gate Valve
SECTION OF LINERS FOR 3½ x 16 FT. TUBE
SECTION OF LINERS FOR 5X20 FT. TUBE
Connect pipe for wash solution or water
¾" Pipe
1" Pipe
3" Transfer pipe to top of next thickening tank
ENG. & MIN. JOURNAL

PIPING UNDER THICKENERS AND OTHER DETAILS OF EQUIPMENT AT LLUVIA DE ORO MILL

washed and assayed, show nearly the same undissolved gold and silver as the pulp from the fourth agitating tank, and yet additional extraction takes place in every thickening tank, when wash solution is added, and even when water wash is added in the flow to No. 10 tank.

INCREASED EXTRACTION BY CHANGING CONTACT SOLUTIONS

To improve the work of the cyanide plant, the thickening tank before the first agitating tank should remove as much as possible of the mill solution, and the pulp should then be thinned for agitation with fresh solution. This change is being made. An additional improvement, which cannot be made in this plant, would be to thicken and add fresh solution between the second and third agitating tanks. The most important fact developed in our operation is that the changing of the solution in contact with the pulp increases the extraction much more than either a longer time of agitation or the use of a stronger solution.

The best results which were obtained under the system of agitation and washing in charges, and filtering the tails, left an average total assay per ton of dry tailing of $2.20, of which 85c. was dissolved. Present results which are being obtained by continuous agitation and washing yield an average assay, per ton of dry tailing, of 93c. of which 15c. is dissolved, and further improvement is expected. Part of this improvement, however, is due to treating a lower grade of ore. In addition, either method could be improved, provided a plentiful supply of water was available.

The change from agitation in charges to continuous agitation, increased the extraction materially, and enabled the use of a reduced cyanide strength, one pound per ton now being used instead of 2½ lb., thus decreasing the loss of cyanide in tailing moisture. Tailing is discharged at an average thickness of less than 60 tons of water to 100 tons solids, or less than 38% moisture.

The greatest advantage is the continuous, almost automatic flow of pulp from the battery bin to the tailing dump, requiring a minimum of labor for attention, eliminating repairs on pulp pumps, and reducing the power required. The capacity of the cyaniding portion of the mill, under the old process, was hardly sufficient to treat suitably 80 tons per day, while the new process of washing easily handles over 100 tons at less expense, and the varying proportions of true slime and sand do not give any trouble.

Cyanide is added in the first agitating tank in a small stream of strong solution. Titrations are made every few hours for free and total cyanide and protective alkalinity in the first agitating tank. The ratio of liquid to solid is taken at the same time for the first agitating tank, and once a day for the discharged tailing sample. The number of tons of solid in any tank becomes of small importance in continuous work. By means of a curve, plotted for the proper specific gravity, with the ratios of liquid to solid as abscissæ, and the weights of 1000 c.c. of pulp as ordinates, the determination consists in weighing 1000 c.c. of pulp and reading the ratio from the curve.

Sand has a tendency to settle in the bottoms of the agitating tanks, but as it should require more time of agitation than the slime, and as the latter has sufficient, there seems to be no reason for extra effort to prevent such settling, especially as it does not become serious, and the extraction does not seem to be affected by wide changes in the ratio of liquid to solid in the pulp.

PRECIPITATION BY BOTH ZINC SHAVINGS AND DUST

The usual method of precipitation with zinc shavings has been used, and in addition, increasing the capacity to about 700 tons of solution per day, zinc dust is being used. Much trouble was experienced in getting good results with zinc dust, but after discarding a plunger pump and using a centrifugal pump, speed of which produces 20 lb. pressure, and no more, at the filter press, most of the difficulties disappeared. By drawing solution from the stock tank, under about 12-ft. head, into a mixing tank, 3x4½ ft., the entering stream being tangential, and regulated by a float valve, the contents of the mixing tank are thoroughly and continuously stirred without any attention. A zinc-dust feeder is mounted on top of the mixing tank, and the dust merely falls into the tank. Another great advantage of the centrifugal pump is the thorough emulsion of zinc dust and solution made while passing through the pump.

The method devised for treatment of concentrate, short zinc and precipitate, so that no valuable byproducts accumulate, was fully described in an article on the electric furnace, published in the ENGINEERING AND MINING

JOURNAL of June 15, 1912. Since that article was written, the use of an air jet in the furnace while smelting concentrate has proved a disadvantage; by correct roasting any matte product is avoided, so that concentrate produces only bullion and slag; and the output of the furnace has been materially increased with added experience in operating.

Rhodesian Mining Notes

JOHANNESBURG CORRESPONDENCE

One furnace is running at the Star of the Congo mine, at Katanga. To date, November, 1912, a total of 28,054 tons have been smelted for 3036 tons of blister copper of about 94% Cu. The chairman, in a recent speech at Brussels, stated that favorable results were being obtained in a shaft sunk 90 ft. below water level, but whether sulphide ore had been met with, or what grade of ore had been found, was not disclosed. To November, for the year 1912, 7660 tons were smelted for 1038 tons of blister copper. The Bwana M'Kubwa copper mine, in northwest Rhodesia, promises soon to become a producer as well as the Kansanshi mine. Above the 350-ft. level, there are in sight 120,000 tons of 14% ore, mostly lumps of malachite in gossan and 700,000 tons of 5% ore. As soon as rail freights are reduced, it is the intention to erect a large plant to operate the Siemens-Halske leaching and electric-precipitation process, which has given good results experimentally. Meanwhile a rough, wet-concentrating plant is ordered to beneficiate the high-grade ore for export.

The Wankie colliery, the only one in Rhodesia, situated near the Victoria Falls, mined 162,816 tons of coal in 1911-1912, and paid £25,000 in dividends. Twenty-eight beehive coke ovens are being erected to supply coke to the Katanga smelting works, and 5000 tons of washed coal per month are ordered also.

The Eldorado mine has struck the reef at the 10th level, showing the continuation of rich ore. The mine has been crippled, however, by the shrinking of the shoot of rich ore from 500 to 110 ft. The Hay mine in 1912 treated 15,509 tons for £18,900, and received £7572 from residues. The mill has now been closed down for development at the mine. The Bucks Reef mine, which was one of the richest producers, has also been offered on tribute, and the East Gwanda mines, comprising the Jessie and West Nicholson, the show mines of the early days, are in liquidation.

Two mines near the Eldorado promise well. The Golden Kopje has 210,000 tons assaying 6 dwt. developed, and the Union Jack, 73,720 tons of 13.4 dwt. Near the Giant mine the New Found Out has 57,000 tons, assaying 12.3 dwt., developed. Unfortunately, the cost of erecting an all-roasting plant to treat 2200 tons per month, will absorb all the profit in sight to the seventh level. The Kimberley mine, at Mazoe, has 170,000 tons of 9 dwt. ore in sight, but the mine is apparently giving out in depth on the granite. Six Nissen stamps and plant to treat 3000 tons per month are being erected at a cost of £35,000.

The Lonely mine is now yielding about £13,000 per month from 4000 tons. The mill will be increased by five stamps to treat 5000 tons per month. The Cam & Motor plant, to treat 18,000 tons per month, will be modeled on West Australian lines, there being two rock breakers in series, driers, Krupp ball mills, Edwards furnace, fine-grinding tubes, sand and slime separators, agitation and treatment plants and vacuum filters for slimes. The neighboring Gatooma mine, the Eileen Alannah, has 216,000 tons of 56s. 5d. ore in sight and 85,000 tons of lower grade. A plant to treat 40,000 tons per annum is on order.

The Falcon mine, in the Umvuma district, has on order a plant consisting of 36 Nissen stamps. The ore will be crushed, concentrated, concentrates sintered and treated in blast-furnace and converter plant, to produce auriferous blister copper. The orebodies are large. On the third level, they aggregate 880 ft. long, 17.2 wide, Cu, 2.45%; Au, 3.68 dwt.; fourth level, 900 ft. long, 36.4 ft. wide, Cu, 3.66%; Au, 5.32 dwt.; fifth level, 580 ft. long, 46.8 ft. wide, Cu, 3.16%; Au, 6.07 dwt.; sixth level, not fully developed, 350 ft. long, 50.2 ft. wide, Cu, 3.22%; Au, 6.35 dwt.

The Giant mine made a profit of £111,800 for the year 1912. The diminishing ore reserves total 243,687 tons, assaying 8.2 dwt. Mining and developing cost $1.89; sorting, crushing, transporting, $0.20; milling, $0.91; general, $0.36; total, $3.36. Some encouragement has been met with in boring to recover the orebody in the lower levels.

The Planet-Arcturus-State mines, in the Enterprise district, near Salisbury, have developed 150,756 tons, assaying 18.9 dwt. This ore will require a roasting plant and a railroad from Salisbury to supply fuel. A promising coal field is being opened 100 miles north of the Eldorada mine, which should prove of much value to these mines, the Shamva and the Cam & Motor at Gatooma. The ore reserves of the Shamva mine, on Sept. 30, 1912, were 2,203,912 tons, valued at £2,323,513. The orebody in the upper level is 740x88 ft., value, 3.8 dwt.; first level, 920x110 ft., 4.14 dwt.; second level, 820x97 ft., 6.77 dwt.; third level, 800x27 ft., 6.0 pennyweight.

Potash Lands Withdrawn

The President recently aproved the withdrawal of three tracts of land, aggregating 133,829 acres, of the desert-basin type in California and Nevada that are believed, as the result of investigations by the U. S. Geological Survey, to contain valuable deposits of potassium salts and brines. The first of these withdrawals covered Columbus Marsh, Nevada, and was approved on Jan. 16, 1913. The second included the famous Searles Lake, California, and was approved on Feb. 21, 1913. The third included lands in the Panamint Valley, California, the acreage affected being 24,567 acres. The withdrawals are not destructive of any valid claims that may now exist.

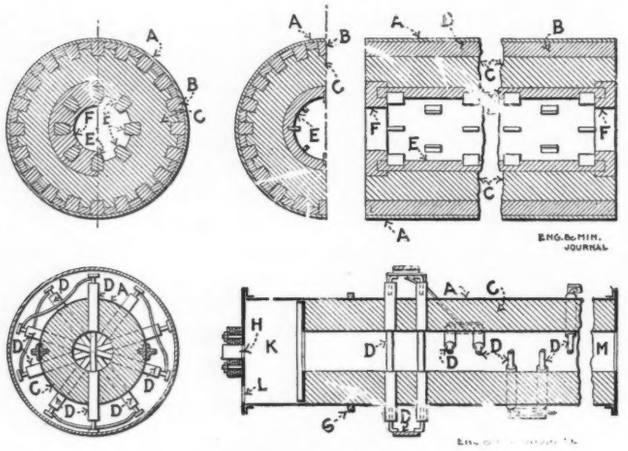
Concurrently with the withdrawals, the Interior Department prepared the draft of a law intended to relieve the present chaotic situation and provide a safe and sure legal basis for the development of the deposits now known and any that may be discovered in the future.

The bitter disputes, says a press bulletin of the U. S. Geological Survey, amounting almost to warfare, that have resulted from the attempts to secure title to the potassium-rich lands of Searles Lake since the discovery of potash there have not only caused the postponement of the highly desirable experimental work on the deposits

themselves but have shown the utter inadequacy of the present laws for the acquisition of lands of this type. The bed of Searles Lake is blanketed with filings, the majority of which have been made under the general placer law providing that 160 acres may be entered as an association placer, but there is danger that the legality of these filings may be destroyed by agreements, made prior to patent, to combine a group of placers after patent is received, in order to obtain an area large enough to serve as a basis for a plant for extracting and refining the salts.

Serpek Furnaces

The recent furnace patents of Ottokar Serpek (U. S. pats. 1,044,927 and 1,044,928, assigned to the Société Generale des Nitrures, of Paris) are of interest in that the reacting material does not form the resistance. According to Serpek, the reaction between alumina, carbon and nitrogen to form nitride, while requiring high temperatures, nevertheless should be conducted under 1800° C., at which temperature aluminum carbide forms. In those furnaces in which the charge forms the resistance, a portion of the material will be converted to carbide, and some will not be converted at all



SERPEK FURNACES

An electrical resistance furnace is shown in the upper view, the left-hand half of the figure representing a section near the end, the right-hand half a section near the center. *A* is a sheet-iron casing, *B* a refractory lining, *C* an inner refractory lining of agglomerated aluminum nitride, and in this lining are fitted resistances, *E*, of a suitable mixture of aluminum nitride and carbon (say from 3:2 to 4:1). The chief refractory materials are either attacked by the materials treated, or else soften or undergo contraction at the high temperatures employed, consequently the inner refractory lining, *C*, of the same materials, is necessary.

The resistances, *E*, are fitted into a carbon cap, *F*, at the end of the furnace, which extends to the sheet-iron casing and carries on its periphery a number of prolongations extending through the casing. All these teeth are connected externally by a metal ring, which connects with a slip ring of wire, or other conductor for supplying the current. At other parts of the furnace than the end, the carbon resistances extend into the furnace, which is given a slight slant toward the discharge end, and by these projections the charge is stirred as the furnace rotates. Other forms of resistance are also provided, such as smooth tubes extending from one end of the furnace to the other, also tubular resistances in which refractory projecting points have been imbedded.

Another form of resistance furnace is shown in the lower figure. In this the metallic casing, *A*, surrounds a refractory lining, *C*, and they are both perforated at suitable points to permit the passage of the resistances, *D*. Each of these is formed of two separate pieces, making contact in the center. The portion of the resistances inclosed in the wall of the furnace is of much larger section than that in the central part, so that the central portion is the one which is brought to a high temperature.

The resistances are arranged diametrically; and each pair is advanced by a certain angle over the preceding pair. However, other arrangements are also provided for. The resistances are preferably arranged in pairs, however, so that if one of the resistances fails, current will pass through the other and the machine can be stopped before damage is done. The supply of nitrogen is taken in through *H*, while the carbon and bauxite (or other aluminous ore) are supplied through *M*, where the exhaust gases also escape. Finished material accumulates in space *K*, and is discharged periodically through grate *L*.

These resistances are made of aluminum nitride and carbon, cemented with gas tar, and then baked.

Washburn Phosphoric Acid Process

Frank S. Washburn, of Nashville, Tenn., has patented (U. S. pat. 1,047,864) a process for producing phosphoric acid from natural phosphates by an electric arc furnace. From a charge consisting of finely divided phosphate rock, silica and carbon in this type of furnace, 90% of the phosphorus present is evolved in a few minutes as a mixture of phosphorus and its oxides. The reactions taking place are explained by the following equations:

$$Ca_3P_2O_8 + 3\,SiO_2 + 5\,C = 3\,CaSiO_3 + P_2 + 5\,CO$$
$$Ca_3P_2O_8 + 3\,SiO_2 + 2\,C = 3\,CaSiO_3 + P_2O_3 + 2\,CO$$
$$Ca_3P_2O_8 + 3\,SiO_2 = 3\,CaSiO_3 + P_2O_5$$

Sufficient air is now introduced to oxidize all the phosphorus to the pentoxide which is absorbed by water, giving a solution of phosphoric acid. The inventor states that experiments showed the presence of carbon and the high temperature of the electric arc to be essential to the success of the process.

Cinnabar Mines in New Caledonia

There are many cinnabar mines in New Caledonia which are not worked, according to the *Bulletin du Commerce*, of Noumea, largely because the mineral laws permit retention of ore deposits, when the holders will not consent to sell them, except at exorbitant figures, which represent neither capital spent nor risk incurred. These cinnabar deposits carry from 1.75 to 2.75% Hg, a metal tenor which would assure great works in Europe or in America. Consequently, it is hard to see why these Caledonian deposits have not attracted more attention. They are found principally at Bourail and upon the east coast at Nakepy, Canala, Kouaoua and Piwaka.

Geology of Bisbee Ore Deposits

SYNOPSIS—Of the ore mined in this Arizona district, 90% has come from 400 ft. of the Martin and Escabrosa limestones. Intrusions and fracturing determine deposition. Three phases of porphyry exist, and three classes of metamorphism recognized. Prospecting is disclosing ore in lower limestones and in porphyry. Some lead ore is now being mined.

The oldest rocks of the Bisbee district are pre-Cambrian, composed for the most part of sediments metamorphosed to schists, intruded by a stock of normal granite, showing only slight metamorphism. From Cambrian time until near the close of the Carboniferous, conformable deposition took place, chiefly of limestones as illustrated in Fig. 1, an ideal section of the district. Then an abrupt elevation of several thousand feet occurred, accompanied by strong deformation, followed by intrusions and minor deformations with the deposition of metallic sulphides. This probably occupied Permian time. Erosion, accompanied by oxidation and enrichment of the primary sulphide mineralization, ensued until the close of Jurassic time, followed by subsidence, during which several thousand feet of Cretaceous sediments were laid down. These vary greatly in character. At the close of Cretaceous time, a gradual elevation and differential tilting toward the southeast took place, accompanied by faulting and erosion, which has continued through Quaternary to present time. This constitutes the second period, during which processes of oxidation and secondary enrichment of the primary sulphide deposits have taken and are taking place.

Lower Carboniferous or Escabrosa limestone outcrops at the surface with the ore at the western end of the property in the original discovery on the Copper Queen claim, and we have the same limestone containing the ore on the 1600 level in the Hardscrabble claim toward the east and again in the Junction mine, at the lowest point as yet developed in the district.

Martin and Escabrosa Limestones Most Productive

The section shows an area of ore, proportional to the tonnage mined to date from each horizon indicated. Similarly the proportion of the intrusion in each horizon is indicated approximately. A point not clear from the projection, and yet of importance in planning development, is the fact that reliable data on the average vertical thickness of ore in the most thoroughly developed portion of the district give a figure between 30 and 35 ft., which is very closely checked by the available data on the less thoroughly explored eastern half of the district. Thus, in general a premium is placed on vertical prospecting, horizontal prospecting from 100-ft. levels being at a disadvantage, except where some major fault has produced a vertical expansion of the ore.

Probably 90% of the ore mined to date, throughout the district, has come from a 400-ft. thickness of limestone, comprising the bottom 250 ft. of the Escabrosa and the upper 150 ft. of the Martin. Practically no ore has been mined in the Naco, the remaining 10% coming from the Abrigo limestones. These lower horizons, however, are becoming increasingly important, as successful prospecting for bodies of unaltered primary sulphides of commercial grade is prosecuted. The intrusives also have, in some cases, been sufficiently mineralized and enriched to form orebodies of high-grade sulphide.

Intrusions and Fracturing Determine Ore Deposition

Ore deposition does not consistently follow either physical characteristics or chemical in the various beds. The massiveness and purity of the limestones show no definite effects. The lack of known ore deposits in the Naco may be largely due to less extensive prospecting and to the fact that many of the intrusions do not penetrate above the Escabrosa. With the exception of the main porphyry stock of Sacramento Hill and the Shattuck dike, the porphyry is conspicuously lacking on the surface, which consists principally of the Naco. Sacramento Hill itself, as an exception to the generalization, is accounted for by the fact that it came up along the Dividend fault, which separates the Palæozoic sediments on the south from the pre-Cambrian schists on the north. The weight of the evidence seems to indicate that the main determining factor in the matter of localizing the mineralization has been the form and extent of the intrusives, and the amount and intensity of premineral fracturing in the sediments.

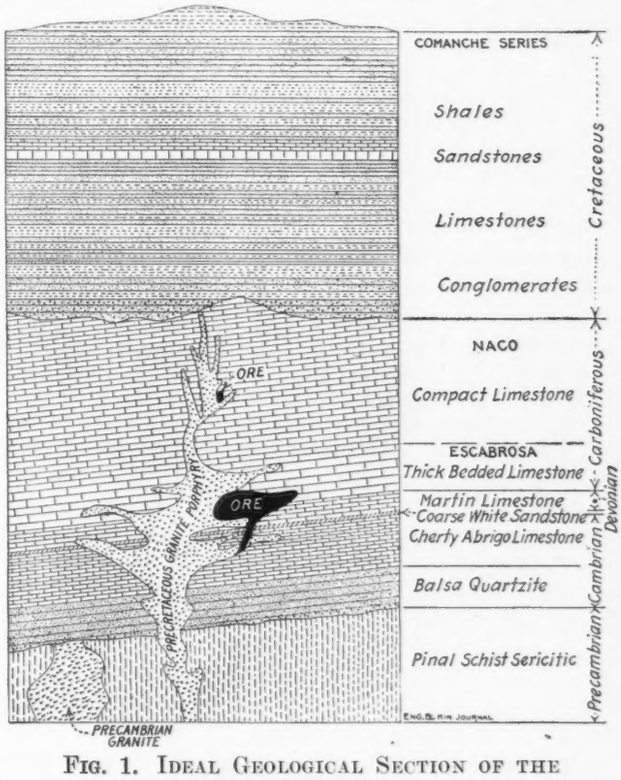


FIG. 1. IDEAL GEOLOGICAL SECTION OF THE BISBEE DISTRICT

Three Phases of Porphyry Exist

There are three fairly distinct phases of the porphyry. The first, of which Sacramento Hill is a type, consists

Note—An abstract of a paper by Arthur Notman presented as part of a series, "The Copper Queen Mines and Works, Arizona, U. S. A.," by James Douglas and other members of the Copper Queen staff, Bull. 101, Institution of Mining and Metallurgy.

of medium-sized phenocrysts of quartz and orthoclase, with a very little albite, in a microgranitic ground mass of quartz, orthoclase and sericite. The second, of which the Shattuck dike and other intrusives in the western half of the district are typical, is similar, except for the larger growth of the phenocrysts, which gives the rock a speckled appearance. In the third, most abundantly developed in the eastern half of the district, there is a distinct falling off in the abundance of the quartz phenocrysts, and the addition of biotite, in some areas in large amount. There is some rather doubtful evidence to indicate that this phase is later than the others. At all events, it is safe to say that the igneous activity was not confined to one eruption, but took place in two or more periods, all of which probably occurred not later than Permian time.

There are two main directions of faulting in the district, striking respectively N 10° W to N 40° E and N 50° W to N 60° E, although there are important faults striking in directions intermediate between these. So far as the relative age of the two systems is concerned, as both are of preintrusive age and have both suffered at least one recurrence of movement in postintrusive time, the evidence is blurred.

Three Types of Metaphorism Occur

Omitting consideration of the regional metamorphism which affected the pre-Cambrian sediments, there are three kinds of metamorphism connected with ore deposition: (1) Contact metamorphism; (2) hydrothermal metamorphism; and (3) hydrometamorphism. The first comprises changes in chemical composition of the sediments induced by the intrusions. The second comprises those changes induced in both sediments and intrusives by ascending magmatic waters derived from the deep-seated uncooled portions of the intrusive magma. The third comprises those changes brought about by descending surface waters.

In general, the effects produced by contact metamorphism may be roughly divided into four main zones extending outward from Sacramento Hill. The actual contact is marked by bodies of pyrite, with associated chalcopyrite, bornite and various metallic sulphides and oxides, as galena, sphalerite and magnetite. Beyond this contact zone, which is 100 ft. to 200 ft. wide, is an extremely irregular zone of silicified, pyritized sediments, from 200 ft. to 400 ft. wide. Beyond this again is the zone of altered, greenish sediments, composed of metamorphic silicates, 500 ft. to 750 ft. wide, which fades gradually into the zone of marbleization, and this, in turn, into the normal unaltered sediments. The details of these zones are extremely irregular, depending on the situation and form of the minor intrusions making out from the hill, the local intensity of fracturing, and the character of the sediments. The characteristic silicates developed are garnet, tremolite, chlorite, diopside, etc.

The locus of the hydrothermal metamorphism is not confined to the sediments, but is controlled largely by the extent of the fracturing. The characteristic alterations consist in the introduction of silica and pyrite with the formation of sericite, alunite, etc. Hydrometamorphism took place in two main periods. The first was during Permian time, when the metamorphosed, mineralized Paleozoic sediments surrounding Sacramento Hill were subjected to subaërial denudation. Those on the north side of the Dividend fault, being at a higher elevation, were eroded much more rapidly than those to the south.

Secondary Enrichment from Erosion

The effect on the mineralized sediments south of the Dividend fault was of tremendous economic importance in forming the rich masses of soft, sooty chalcocite at and below the existing water level and the famous oxide and carbonate ores above water level. A possible source of this secondary enrichment is the copper contained in the eroded Paleozoic sediments north of the Dividend fault. There is no reason to suppose that these sediments were any less thoroughly mineralized than those south of the fault.

Surface Gossans Distributed Similarly to Intrusions

Surface gossans are more numerous and intense in the Escabrosa, Martin and Abrigo limestones than they are in the Naco, and also increase in number and size as we approach Sacramento Hill, or the major fault zones. The underground equivalents of these surface indications are far more extensive.

As we go to the east, the surface indications become fewer and smaller, showing only where the mineralization extended upward along some major fracture zone. The composition of these surface and underground gossans is hematite, limonite and manganese oxide, associated with rusty silica, and, in a few instances, showing malachite stains. They are the result of oxidation of the primary masses of pyrite, chalcopyrite, bornite and associated sulphides and silica.

Underground Gossans Striking Features

The underground gossan, or zone of oxidation, is composed of the oxidation and decomposition products induced in both sediments and intrusives by contact and hydrothermal metamorphism. The result is a practically continuous zone of these products overlying the zone of sulphide enrichment. Surrounding this zone, on top and sides, is a noncontinuous shell of deposits of malachite and azurite, with associated oxides of manganese, which often make off into fissures in the outer shell of marbleized limestone, which in turn surrounds the zone of metamorphism. Within the zone of oxidation and generally immediately above the bottom occur rich bodies of cuprite, tenorite and native copper, with a little associated carbonate. A possible explanation of the preponderance of the carbonates where found is the fact that there was sufficient excess of CO_2 present to convert the oxidized products of the original copper sulphides to the carbonates, which are apparently very stable under the action of descending surface waters; while, well within the zone of metamorphism, under the influence of oxidation, with insufficient CO_2 present, the bulk of the copper is carried down through the zone of oxidation and deposited, as secondary sulphides, at and below water level, and is subsequently converted to the oxides and native copper by a lowering of the water level. In the accompanying diagram (Fig. 2) is shown an ideal section indicating the relations described above.

The material composing this zone of oxidation consists of the oxides of iron, hematite and limonite, the carbonate siderite, silica and a number of alumina compounds, chief among which are kaolin and alunite, and gibbsite

has been recognized. Associated with these but, as noted, generally at or near the outer shell, are large amounts of the oxides of manganese.

Irregular Lower Contour of Zone of Oxidation

In a number of instances, the lower contour of the zone of oxidation has been so irregular, due to faulting or other causes, that horizontally within a few feet are found primary sulphide, secondary sulphide and oxides of copper. In other places, cores of unaltered primary sulphide, inclosed in a shell of secondary sulphide are found, as it were, in completely oxidized material.

It is interesting to consider which of the two periods of oxidation and enrichment has been of the most importance economically. So far as the evidence is available, the grade of the ore at the eastern end of the district, where the first period alone has affected it materially, is little, if any, lower than at the western end,

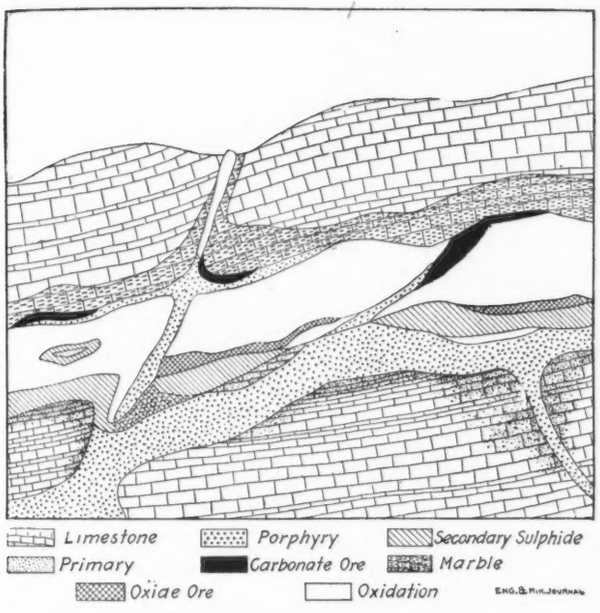


Fig. 2. Section Showing Ideal Relations of Sedimentaries, Intrusives and Ore

and it would therefore seem that the first period was the most important.

Primary Ore

Although the importance of these processes in concentrating the copper in the Bisbee deposits can hardly be over-estimated, fortunately for the future of the camp, during the last three or four years prospecting has been successfully directed toward the discovery of profitable orebodies of primary origin. These deposits, so far as developed at the present time, add about 800 ft. to the prospective depth. But it must be borne in mind that such work will have to be prosecuted without the aid afforded by the overlying zone of oxidation. Guidance will have to depend principally on the form and location of the main intrusive masses, the location of faults and fracture zones, and the determination and recognition (if they exist) of favorable horizons in this 800 ft. of Abrigo limestone.

Another possible future source of ore in the district, the investigation of which has barely started, but with favorable indications, as far as the development has progressed, is the porphyry stock of Sacramento Hill. It is quite within the range of possibilities that profitable bodies of disseminated chalcocite ore, suitable for concentration, will be developed there. There are also indications pointing to the possible existence of vein-like occurrences along the major fractures in the porphyry, of pyrite with associated chalcopyrite, bornite, chalcocite and covellite, which, even below the zone of enrichment, may constitute bodies of profitable ore.

Lead Ore Mined at Present

In the past two years an increasing tonnage of oxidized lead ore, with associated gold and silver, has been secured from small, widely scattered bodies, generally found in the upper portion of the oxidized zone, and, in a number of cases, extending to the surface along mineralized fractures. The ore consists of cerussite and anglesite, with associated halogen salts of silver, and probably free gold, in a gangue of porous silica and limonite. In places, the silver and gold continue without the lead, and *vice versa*. These occurrences, when they become more readily recognized, promise to add materially to the precious-metal production of the district. As yet the question of their genesis has not been carefully studied; but the evidence seems to indicate a similar origin to that of the copper deposits, they having been derived, by secondary processes, from the galena and gold and silver associated with pyrite and copper sulphides of the primary mineralization.

Uranium and Vanadium in 1912

The production of uranium for 1912, from preliminary estimates of the U. S. Geological Survey, was equivalent to about 26 tons of uranium oxide or approximately 22 tons of metallic uranium, a slight increase over 1911. The vanadium output for 1912 is estimated as equivalent to a little less than 300 tons of metallic vanadium, a somewhat larger quantity than that of 1911. Uranium and vanadium ores in 1912 came chiefly from southwestern Colorado, with a smaller production from southeastern Utah between the San Rafael Swell and the Colorado line.

The uranium-bearing ores were all carnotite, a variable compound of uranium and vanadium with other elements. So far the richest and largest deposits found are in Montrose County, Colo., and Paradox Valley, Long Park, the McIntyre district and adjacent territory, extending into San Miguel, Dolores and Mesa counties. In Utah the deposits mined are in Emery and Grand counties. The percentage of uranium oxide (U_3O_8) in the ore varied from 0.5 to 6.32. The percentage of vanadium oxide (V_2O_5) in the same ore varies from 1.42 to 13.63. The larger part of the vanadium ore produced was a sage-green sandstone colored by the vanadium-bearing mica roscoelite. It was mined near Newmire, San Miguel County, Colo., and the vanadium was obtained in the form of iron vanadate at the local reduction plant of the Primos Chemical Co. The iron vanadate is smelted into ferrovanadium in the East.

Prices varied greatly, but 25 to 30c. per lb. for the contained vanadium oxide and $1.30 to $1.50 per lb. for the contained uranium oxide, where it exceeds 2½%, seems to have been the rule. The prices were considered too

low by some producers and their ore was stored awaiting a rise. Most of the ore goes to England and Germany and is said to be wanted especially for the radium content. The price of metallic vanadium was much below former years and from $4 to $5 per lb. it fell to $2.50 and $2 for the contained vanadium in ferrovanadium, undoubtedly owing to competition between American firms. The use of vanadium steel seems to be growing rapidly. No extensive use for uranium is known to have been developed but the glass, pottery and chemical trades use small quantities.

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Canadian Mineral Production for 1912

The total value of the mineral production in Canada in 1912 as given by a preliminary report of the Canadian Department of Mines was $133,127,489. Compared with the previous year, this total shows an increase of $29,906,495. The mineral output in 1911, however, was somewhat restricted, owing to long extended labor disputes and the largest previous production was in 1910, compared with which that of 1912 shows an increase of $26,243,866.

The only new camp of importance to contribute largely to the year's output was Porcupine, the gold production of which was about $1,750,000. A substantial increase in price in most of the metals throughout 1912 had an important bearing on operations for the year and contributed largely to the increased value of the output.

PRODUCTION OF PRINCIPAL MINERALS IN CANADA FOR 1911 AND 1914

	1911	1912
Metallic:		
Copper, lb.	55,648,011	77,775,600
Gold, oz.	473,159	607,609
Pig iron from Canadian ore, tons	42,186	36,355
Pig iron from imported ore, tons	875,349	978,232
Lead, lb.	23,784,969	35,763,476
Nickel, lb	34,098,744	44,841,542
Silver, oz.	32,559,044	31,931,710
Nonmetallic:		
Asbestos and asbestic, tons	127,414	131,260
Coal, tons	11,323,388	14,699,953
Gypsum, tons	518,383	576,498
Petroleum, bbl.	291,092	243,336
Salt, tons	91,582	95,053
Cement, bbl.	5,692,915	7,120,787
Lime, bu.	7,533,525	7,992,234

The production of the more important metals and minerals for the two years 1911 and 1912 is shown in the accompanying table. Of the total production in 1912 the value of $61,177,980, or nearly 46%, is credited to the metals, and $71,949,500, or 54%, to nonmetallic products. With the exception of petroleum every important mineral mined in Canada shows an increased production in 1912, so far as value is concerned. In the case of silver only is there a decrease in quantity, and this slightly less than 2%. Among the metals increases in quantity of output are shown as follows: Pig iron 10.5%; gold, 28%; copper, 40%; and lead, 50%. The most important increases among nonmetallic products are in coal, gypsum and cement. The preliminary estimates of the iron-ore production for 1912 are 175,000 tons as compared with 210,344 tons in 1911. In respect to value of mineral production, Ontario is still the largest contributor to the total, being credited with 38%; British Columbia comes second with 22%; Nova Scotia, third with 14%; Alberta fourth with over 9%, and Quebec fifth with a little under 9%. In Nova Scotia both coal and gypsum mining were particularly active, although a reduced production of gold is reported. Copper and asbestos mining in Quebec contributes chiefly to the increase in that province. Ontario had important increases in nickel and copper but more especially in gold from the Porcupine district. In Alberta coal mining has had a record year, exceeding in tonnage the British Columbia production. In the latter province the principal increase was in copper with gold, silver, lead, zinc, coal and structural material as important contributors.

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Ajax Anti Rust Sheets

The ordinary ways of protecting iron against rust by a metallic coating are: Tin plate (tin coating); terne plate (lead-tin coating); lead-covered plate; galvanized plate (zinc coating). The first three methods are examples of coatings with metals almost inert to atmospheric corrosion, but electronegative to iron. Consequently any imperfection in the plate, which allows an electrolyte to enter, results in accelerated corrosion beneath. These plates are therefore usually covered with paint to fill up any imperfections in the coat.

In galvanized iron, the coating is electropositive to iron, and therefore oxidizes before the iron does. Rust, therefore, will not appear on galvanized sheets until the zinc coating in the neighborhood of the imperfection is completely destroyed. Galvanized sheets then, do not require painting as the tin do.

The recently patented Ajax Anti-rust sheets of the Ajax Lead Coating Co., of Philadelphia, Penn., consist of a galvanized black plate, over which is placed a coating of lead. The iron is, therefore, protected by electropositive zinc; the zinc by the chemically inert lead. Furthermore the lead penetrates the zinc coating, making it less likely to scale off when the plate is bent. The plate is recommended by the manufacturers for roundhouses, dyehouses, and other buildings where destructive fumes and gases of various sorts are present.

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Nova Zembla Copper Deposits

Prospecting and exploration work has been done by an Odessa, Russia, company on some copper outcrops of the island of Nova Zembla. A surveying expedition in 1911 discovered copper showings and in 1912 a fully equipped party was sent to investigate. Trenching, sinking and diamond drilling were employed to outline the deposits if possible.

The district lies at the southern end of the peninsula of Miedny, in the vicinity of Lost Bay, according to information furnished by the "Mining Society of the Novaya Zemlia," in Odessa. Apparently three veins were investigated. One on the south side of a mountain range is near the coast and dips south at about 70° under the water. Another on the northeast side of the range dips northeast toward that coast. The principal metal content of these seems to be native copper. Between the two is a third vein, which carries chalcopyrite mainly. The gangue is given as epidote, calcium sulphate and quartz. The country seems to be mainly igneous.

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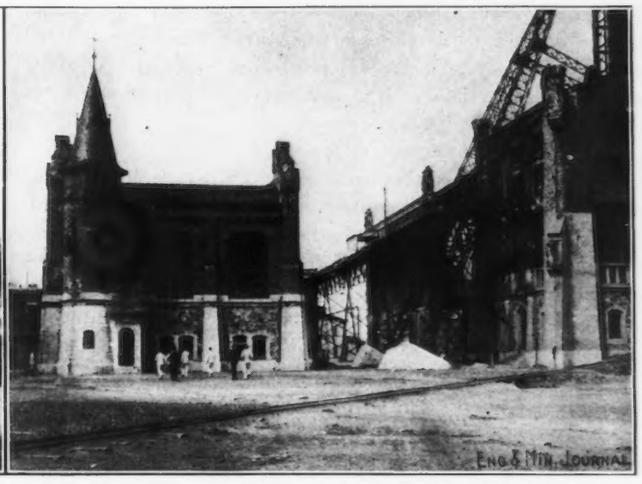
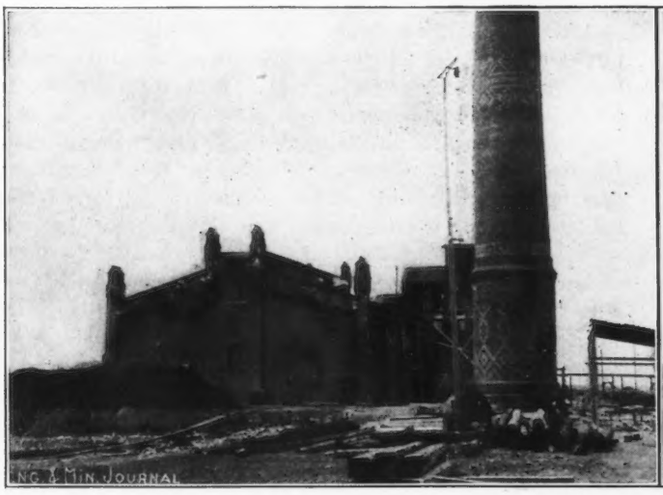
The Usine Electrolytique de Moscou has been organized in Russia, with a capital of 1,200,000 rubles, to build and operate an electrolytic refinery for the treatment of copper. The works will be near Moscow and will be erected at once.

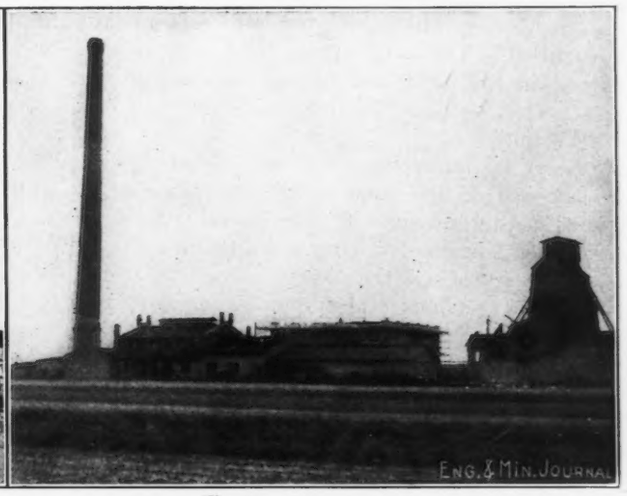
PHOTOGRAPHS FROM THE FIELD

ALLER NORDSTERN, THE MOST NORTHERLY POTASH MINE IN GERMANY

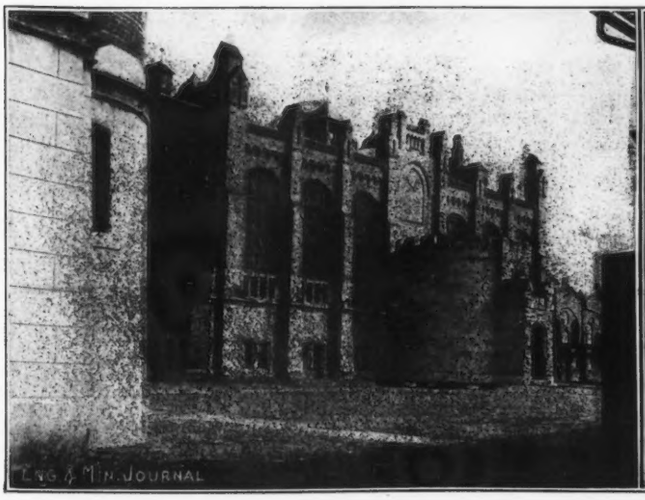


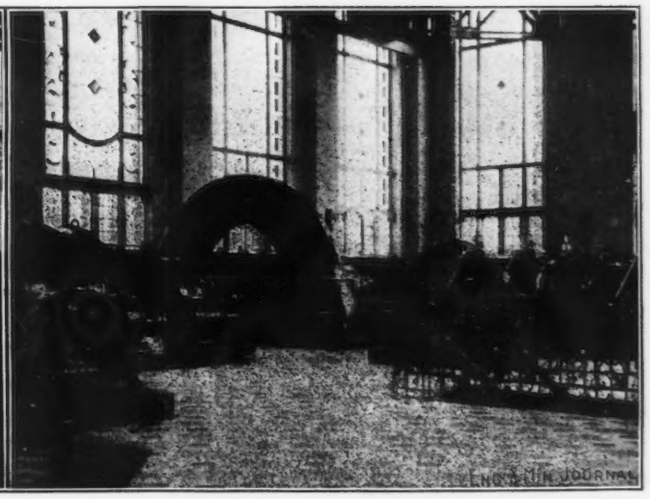
SHAFT BUILDING AND HOISTING HOUSE AT THE FRIEDRICHSHALL POTASH MINE





BOILER HOUSE AND SHAFT BUILDINGS IN COURSE OF CONSTRUCTION AT SARSTEDT POTASH MINE





TWO VIEWS OF THE ORNATE POWER PLANT AT THE FRIEDRICHSHALL MINE

Electric Equipment, American Nettie Mine

By T. A. Tefft*

SYNOPSIS—The American Nettie mine is situated on a precipitous slope in the Uncompahgre Valley, near the town of Ouray, Colo. The Uncompahgre River is the source of power for the hydro-electric plant constructed a few years ago. The methods of constructing this plant and the transmission line are given, together with results of efficiency tests.

The American Nettie gold mine, Ouray, Colo., is situated in a mountainous country isolated from the railroad. This situation necessitated the bringing in of all the mine machinery and most of the materials for the hydro-electric plant and transmission line over a burro trail. A good example of the difficulties to be overcome in transportation and construction work in mountainous districts is thus furnished.

Steep Crooked Trail Made Transportation Difficult

The transportation of the materials for the electric station and machinery was done by wagons in the usual manner. The equipment for the mine had to be taken over a steep, crooked and more or less dangerous trail. All apparatus had to be entirely dismantled. The small parts and attachments were packed in ore sacks and carried on burros. The next larger sizes, such as bearings, small gears, pulleys, etc., were wrapped in sacks and loaded on mules. All pieces too heavy for mules or of such shape that they could not be balanced on the pack saddles, were moved on sleds. These sleds were made of 2x4-in. pine, from three to eight feet long, and having a width of 20 in. A sled was used for each of the pieces such as armatures, fields, pole pieces, sections of bed plates, gears, cylinders, air receiver, etc. Some of these pieces required the use of four horses in tandem to move them on the trail.

In passing the zigzags, the use of blocks and ropes with two horses pulling down hill, was found to be the most secure and rapid method. Several of the parts of the equipment required three men with the use of four horses, and a good supply of tackle, crowbars, etc., working about five days to move each one to the mine from the railway station, a distance of about 2½ miles. Only a few pieces received scratches, and only one piece jumped the trail, and that fortunately did not sustain serious injury.

Uncompahgre River Source of Power

The source of power for the hydro-electric plant, constructed a few years ago, is the Uncompahgre River, a mountain stream fed by springs and heavy snows. There is a great variation in the volume of the flow of the stream, the lowest being in February and March, when there is the least thaw and the streams are frozen. The flow at this time was found to be 960 cu.ft. per minute. The river also had a daily variation, being lowest about 3 a.m., and highest in the evening. The flow is also cut off temporarily at times by big snow slides which close the stream until it can melt through them. The highest water is in early July, when the first hot days in this region bring down all the snow from the immediate foot hills. No measure was secured of this flood stage.

A 30-ft. log dam, a penstock 18 ft. high by six feet square, and 400 ft. of 4x5-ft. flume with sand box and screens were erected in the winter during the lowest stage of water. Ten feet of the penstock were built of 2x6-in. plank laid flatwise in tar and spiked together; the upper eight feet of 2x4-in. planks. Four 1-in. anchor bolts extended through the entire height. The pipe line was 1400 ft. long, 30 in. in diameter and made of No. 14 Brown & Sharpe steel. These plates as received were 3x8 ft. and weighed from 65 to 70 lb. each. After the plates were punched, rolled and riveted, six of them were put together to form a section 17½ ft. long. The horizontal seams were double riveted and the vertical ones single riveted. These sections were then dipped in a hot bath of maltha and coal tar and thoroughly coated inside and out. Ten barrels of the compound were required for the job.

Method of Constructing Flume

After drying they were hauled to the grade and put together as follows: Beginning at the wheel end the sections were united by a 6-in. telescope joint. The larger ends of the sections were expanded by sprinkling with gasoline and firing. This process also softened the compound and aided in making a tight joint. The sections were forced together by using a set of triple blocks on each side, two men operating each set of blocks and a fifth man guiding the end of the pipe and at the same time jarring it to a tight fit by using a sledge against a block of wood on the end of the pipe. As the line was straight, and the fall not over 75 ft., this style of joint proved effective. Since the wheel opening was but 24 in., a reducing section was necessary at this end. A 14-ft. manhole and a hose connection were also placed in this section. The connection at the penstock was enlarged from 30 to 36 in. to allow an easy entrance for the water.

A 3-in. air valve was inserted in the pipe on the highest vertical bend. Most of the pipe was laid on an elevated grade. It crossed the stream from which the water was taken, and required two special bridges for this transfer. Practically the whole of the pipe was therefore subject to the extreme changes of temperature. Such a pipe should be kept full of water to prevent undue expansion and contraction. If not, there will be excessive leakage.

The building erected to house the machinery was a two-story frame structure 30x32 ft., the second story being used as a residence for the operator. The plan was made to accommodate duplicate generators to be operated by a 20-in. double-discharge. Leffel turbine with horizontal shaft and friction-clutch pulleys, 28 in. diameter by 13-in. face, one for each unit. The foundations for machinery and building were made of rock and cement. The I-beams composing the longitudinal part of the frame having become deflected sidewise by the wa-

*Jamestown, N. Y.

ter pressure, it was necessary to bring them into line again by the use of jack screws, and then to extend the concrete foundation to the top of the beams.

The wheel was fitted with a Wood governor, which worked well for small variations of load, but for large ones like that caused by the starting of a compressor, it was of no value in this plant. When such changes were to be made, the operator was notified by telephone, and hand regulation was applied to the wheel. Without this hand regulation, the incandescent lights would be destroyed when a heavy load was thrown off. The plant was operated continuously. The switchboard was made of kiln-dried maple, and arranged for the duplicate 60-kw., 500-volt compound generators.

Difficulties of Transmission Line Construction

The transmission line extended over a rough section of country, and was rather difficult both to locate and to construct. There were several zigzags so as to cross the cliffs where it was possible for men to approach the route. Trees were used for poles wherever possible. Other poles were cut from the nearest timber, and rolled or dragged into position and set in holes made in the rock by the use of dynamite. Heavy guys and double cross-arms were frequently used along the line.

The wire, 000 B. & S. bare copper, was received on wooden spools in lengths of 1000 ft. (500 lb.) It was desired to take about one-third of these coils to the mine and run them out from that end. As 500 lb. was too heavy for one mule to carry, and it was preferable not to cut the wire, the following method was used. The wooden spools were removed from the wire, and the coils separated into four parts with connecting links. Two of these were paced on the pack saddle of one mule, one on each side, so as to balance. The other two were similarly placed on a second mule, the animals being connected by the 10 or 15 ft. of wire between the two loads. The outfit could then move single file up the trail. At the mine the four sections were replaced on the spools, which served as reels when placed on a spindle anchored to a tree.

The end of the wire was passed through a friction clutch made of two pieces of plank bolted together, and then guided down the route of the poles by several men. A second section was then spliced and soldered to the first, and the operation continued until 3000 ft. of wire was drawn out, 1500 ft. on each side. Other sections were then drawn out by men and horses from various points along the route which could be most easily reached, for the total length of 4400 ft. The completed joints were made Western Union style and soldered by pouring the molten solder over them. The wire was laid up and drawn into position in the usual manner. Special railway insulators were used to anchor the wire on the tops of high bluffs. Care should be taken in such rough country to set the cross-arms on the poles so that the grooves of the insulators will be in line with the wire, also that such construction be made extra strong.

The mine consisted of a series of tunnels opening in the face of quartzite ledges on the mountain side at an elevation of about 9500 ft. These tunnels were connected by a network of excavations from which ore had been taken. The tunnels were of irregular size, varying from that of a rectangle less than 4x6 ft. to large stopes. The mine was practically dry, though some water accumulated in two or three places. The mine equipment was as follows: One 12x12-in. high-altitude type of Norwalk compressor, a No. 4½ Baker blower, and a Lidgerwood hoist. The machines were housed in good-sized rooms made of boards and corrugated iron. It is necessary to cover such machines with a tight and strong roof to prevent small pieces of rock from dropping into the working parts.

Compressor Placed in Mine

The compressor was set in an offset from the main tunnel about 1000 ft. from the entrance, and near the work to be done. This situation is important, as it saves power, cost of installation, and avoids loss by leakage of pipes. No. 0 Brown & Sharpe insulated wire was used in this tunnel. The compressor was operated by a 35-kw. shunt motor geared on the same bed plate. The air receiver, 30 in. in diameter by 10 ft., was placed about 20 ft. from the compressor. The jackets of the air cylinders and the intercooler were supplied with water from two 735-gal. tanks situated about 100 ft. from the compressor. A centrifugal pump was driven by belt from the intermediate shaft of the machine, and forced the circulation of the water through suitable piping. From 10 to 18 gal. of water per minute were passed through the compressor. The speed of the compressor varied from 150 to 200 r.p.m., and when operating two Ingersoll-Sergeant drills and furnishing blast for one forge at a pressure from 60 to 80 lb., the motor required from 65 to 80 amperes at 450 to 475 volts.

The No. 4½ Baker blower was situated about 200 ft. in the tunnel in the Y formed by a branch. A 15-in. galvanized-iron pipe extended from the blower to near the head workings. The blower was operated by a 6-kw. shunt motor arranged with a reversing switch so that the smoke could be exhausted directly from the head of the mine without scattering it through the other tunnels. Also by this method fresh air could be sent directly to the miners, and the work carried on with the least interruption possible. The blower required seven to 10 amperes at 475 volts.

Electric Hoist Used

The hoist was set up in a branch from the extreme inner end of the main tunnel about 300 ft. from the compressor. It was of the Lidgerwood style, operated by a 25-kw. series street-car motor controlled in the same manner. It was arranged with a drum for 600 ft. of ⅞-in. wire rope in one layer. The shop test of the motor showed 1300 lb. raised 600 ft. per minute. The normal load was 700 lb. at 600 ft. per minute. The wire in the tunnels was of heavy weatherproof insulation tied to heavy porcelain insulators bolted to wooden pins which were driven into holes drilled in the quartzite roof and walls. There was a heavy condensation of moisture on the insulators and wire. This was effectually prevented by coating them with P. & B. paint.

One of the greatest troubles experienced in the operation of high-altitude electrical plants is from lightning. Electrical storms are of frequent occurrence, heavy discharges from the lines occurring sometimes during clear weather. The arresters used on this plant were of the General Electric magnetic blowout type. Four were placed at the mine, and two at the station. As the mine was a dry one, it was difficult to get a suitable ground at that end. A good-sized basin was blasted out

of the quartzite near the mouth of the tunnel, this was filled with charcoal, and the arresters grounded to a copper plate placed in it. The basin was kept damp by water occasionally thrown in it.

A rough test was made of the station. While not strictly accurate, it may be of some value in planning such installations. When the output of the generator was 85 amp. at 575 volts, the average velocity of the water in the tail race was 188 ft. per minute. The tail race, 6 ft. 7½ in. wide, 4 ft. deep and 150 ft. long, was made of planks and had a fall of $\frac{3}{16}$ in. per foot. The water velocity as given was obtained by determining the time for light floats to travel about three-quarters of the length of the race. These floats were placed in the middle, and in various parts of the surface of the stream. The depth of the water for this load was from 9¾ to 10 inches.

The approximate volume per minute was then as follows:

$$\frac{79\frac{1}{2} \times 10 \times 188}{144} = 1038 \; cu.ft.$$

The elevation of standing water in the penstock was 103 ft. above datum; elevation of standing water in the lower end of draft tubes 26.2 ft. The total head was therefore 76.8 ft. The friction loss in 30-in. pipe for 1038 cu.ft. per min. is 4.3 ft. Hence the effective head was 72.5 ft.

$$Horsepower\ of\ water = \frac{1038 \times 62\frac{1}{2} \times 72.5}{33{,}000} = 142$$

$$Electrical\ horsepower\ output = \frac{85 \times 575}{746} = 65.5\ hp.$$

The velocity of water in tail race for friction of station plus forty 20-cp., 3.6-watt lamps was 88.8 ft. per min. and the depth 4 in. This gave a volume of 196 cu.ft. per min. Then

$$\frac{196 \times 72\frac{1}{2} \times 62\frac{1}{2}}{33{,}000} = 26.9\ hp.$$

the amount of power required for station friction and the 40 lamps.

Royal Dutch-Shell Oil Group

In the week ended Feb. 13, 1912, the Royal Dutch Oil Co.'s shares sold in Amsterdam at 590, the highest point ever reached in its history. The Amsterdam correspondent of the New York *Times Annalist,* writes that the Royal Dutch-Shell Oil group has secured control of the principal oil fields of the Dutch East Indies through the Consolidated Dutch Oil Co., of a large output in Roumania and Russia, of the Red Sea oil fields, and, during the week under review, rumors were current that it was attempting to acquire control over the Emba field in Russia, and that it had acquired valuable oil land in America, thus getting a foothold in that part of the world and preparing for active competition with the Standard Oil Co. It was understood several months ago that the group had obtained large interests in California and that an important field in Mexico had been acquired, but the news is now circulated that the group has secured several thousands of acres of oil land in Oklahoma embracing oil wells producing 5000 bbl. per day, together with storage facilities and refining plants. These were secured through the intermediary of the American Roxana Co. It now seems that the Royal Dutch-Shell group is to become an important force on the American Continent.

Report of Yukon Gold Co.

The most interesting feature of the Yukon Gold Co. report for 1912 relates to the acquisition of dredging ground in the Iditarod district. There were secured, either by working agreement or by purchase, 24 claims, which gives practical control of Flat Creek, the principal producing creek of the district. The dredgable area is reported to contain about 5½ million cubic yards, much of which is thawed, and extends about four miles from the head of the creek to the mouth.

Dredge No. 7 completed its work on Upper Hunker Creek, in the Dawson district, in October, 1911, and was moved to Iditarod, where it was rebuilt on the upper end of Flat Creek, on the Marietta claim. A 300-kw. plant was built near the Bonanza claim on the same creek, to furnish the dredge with power. The installation consists of a steam-driven turbine, direct-connected to a 4400-volt generator, a boiler plant and a transmission line two miles in length. The plant began operations on Aug. 15, 1912, and handled 172,333 cu.yd., producing $404,040 worth of gold at a total cost of $79,114, or a cost per yard of 45.91c. on $2.34 gravel. On Oct. 29, operations ceased for the winter.

1912 OPERATIONS OF YUKON GOLD CO.

Assets	1912	Liabilities	1912
Property & investments	$12,026,120	Capital stock	$17,500,000
Equipment	6,935,801	Guggenheim Explo. Co.	2,524,972
Deferred charges	441,279	Bills & accts. payable	202,272
Supplies and materials	879,292	Depreciation	568,893
Advanced royalties	340,604	Surplus	*409,275
Accounts collectable	502,965		
Cash	97,351	Total	$21,223,414
Total	$21,223,414		

* Surplus is after payment of dividend Dec. 31.

Operation	Gross Production	Working Costs	Operating Gain
Dawson dredges	$3,346,027	$1,580,290	$1,765,737
Dawson hydraulicking	629,044	277,953	351,091
Iditarod dredge	404,040	79,114	324,926
Miscellaneous	484,337	204,672	279,666
Total	$4,863,448	$2,142,029	$2,721,420

In the Klondike district, some few purchases of outstanding claims were made and some additions in the way of pipelines, cuts and sluices made to the hydraulic equipment. An operating season of 172 days was obtained, from early in May until Oct. 24, for the Dawson dredges, during which time there were mined 5,157,280 cu.yd. of an average value of 64.88c., at a cost of 30.64c. per yard. The yardage for the year was increased by about a million, and the gross production about $674,-181. The value per yard increased 0.53c. and the cost decreased 4.79c. per yard. Of the area mined, 509,544 sq.yd., or 73.58%, had to be thawed.

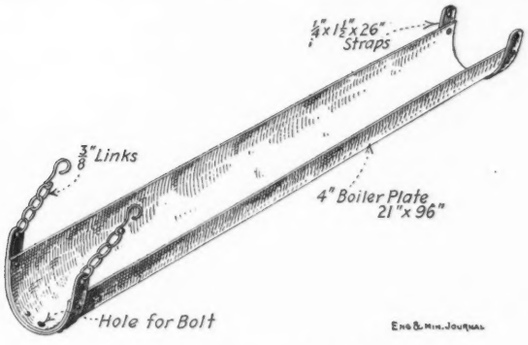
The hydraulic mines handled 2,967,750 cu.yd. of gravel, averaging about 21.2c. per yd. The increases over the previous year were 842,000 yd. and $195,000. The value per yard increased slightly and the cost was reduced from 15.5c. to 9.37c. per yard. The hydraulic water system is now in excellent condition.

The accompanying table summarizes the results for the year. From the net operating profit as shown, there were deducted $692,995 for royalties paid; $577,146 for amortization and deferred charges; $378,686 for interest, general expenses and examinations, or $1,648,827 as a total.

DETAILS OF PRACTICAL MINING

Flat Dips and Chute Conveyors

In mining a flat-dipping orebody, the problem of handling the muck is serious. It may, under certain conditions, be a more important factor on the cost sheet than the actual breaking of the ore. The simple and primitive way of getting the broken material to the cars under such conditions, is by successive shovelings down the stope. This is tremendously expensive. With bodies dipping at an extremely flat angle, the tracks may be run diagonally on a rather steep grade and the face kept diagonal to correspond. If the orebody is thick, a succession of chutes and level tracks may be used, thus stepping the ore down. This means several handlings and cannot be applied in a narrow vein. Some advantage can always be gained by cutting out the footwall and thus moving a level track toward the face, but this soon becomes prohibitively expensive. In general the systems most applicable and satisfactory are, that involving the use of a gravity plane, as in the go-devil method of the North Star mine, in Grass Valley, Calif., or that involving shaking chutes, which is in use in South Africa. The go-devil system is extremely flexible and efficient. The ore is lowered in balance on an incline, which at its top, branches approximately at right angles into level tracks. When the advancing face gets too far above the tracks for easy shoveling, the incline is run up another lift and a new pair of tracks started out. The operation of shaking chutes necessitates extra labor. Labor is relatively cheap in South Africa and high in California, and the choice between these two systems may depend on the price of labor.



CONVEYING CHUTE

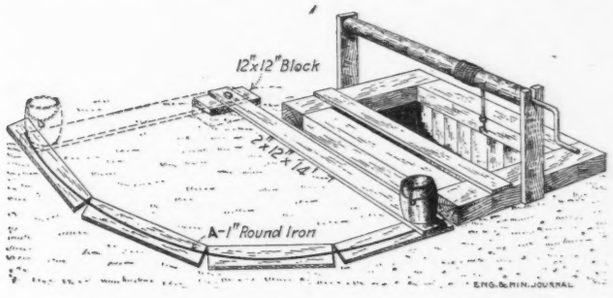
A convenient form of shaking chute is shown in the drawing. The chains to the end bands are conveniently attached to eye-bolts in the hanging wall. At the end a hole is provided in the bottom for a bolt to connect successive sections. The number of sections is limited by the weight which can be easily swung. The troughs are made of ¼-in. boiler plate, two being obtained from each standard sheet, 42x96 in. The straps binding the ends are ¼x1½x26 in., the chains are of ⅜-in. material. The action of the chutes is obvious. A line of them is hung from the car or bin to the shoveling point near the face and as muck is shoveled into them, they are swung in the direction of their long axis and the material is conveyed by bumping to the lower end. In case it is possible for the muck to slide without bumping, the troughs can be laid on the footwall, in a zigzag fashion if desired, so as to reach the shoveling point in the most convenient manner.

❋

Device for Handling Prospecting Bucket

The device illustrated is similar to one described by Algernon Del Mar in the JOURNAL of June 4, 1910, but differs from it in the employment of an iron runner for the revolving board instead of a curved board on edge, and in leaving only a short and unbalanced portion on the end opposite the bucket. This description, furnished by Thomas M. Smither, of Reno, Nev., applies to an installation of the device in the Goldfield district.

The action of the contrivance is apparent from the drawing. The hoisted bucket is released and placed on the movable end of the board, which is then revolved about its pivoted end by sliding on the track *A* until the dumping point is reached. The fixed end of the 2x12-in. by 14-ft. revolving board is bolted to a 12x12-in. block with washers inserted to insure easy motion. The 1-in. round iron *A* is an old cyanide tank hoop. It is fastened to the supporting boards by nails on the sides, the heads of which are kept below its top. Pipe or rail would answer the purpose as well. The bottom of the board was protected against wear on the moving end by iron straps. The iron was greased and the loaded board easily moved thereon.



PROSPECT BUCKET DUMPING ARRANGEMENT

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Right and Left Handed Muckers

In drifting, the problem of mucking is often more difficult to solve than that of drilling and breaking the rock, especially if high speed is to be maintained. This was the situation met with in the Rawley adit, as described by Messrs. Simonds and Burns in their paper at the February meeting of the American Institute of Mining

Engineers. It was found necessary to plan the cycle of mucking and tramming operations down to small details and to adhere rigidly to the routine. One of the unexpected obstacles encountered was rather amusing, namely, the difficulty of so matching the muckers at the face that for each pair throwing right-handed, there should be a pair throwing left-handed, four being the number of muckers used. This was especially troublesome, as the labor supply was limited, and while not the first consideration in hiring a prospective mucker, yet his right- or left-handedness with a shovel was a matter of considerable importance, and was always kept in mind.

❋

Topographic Sketching Method

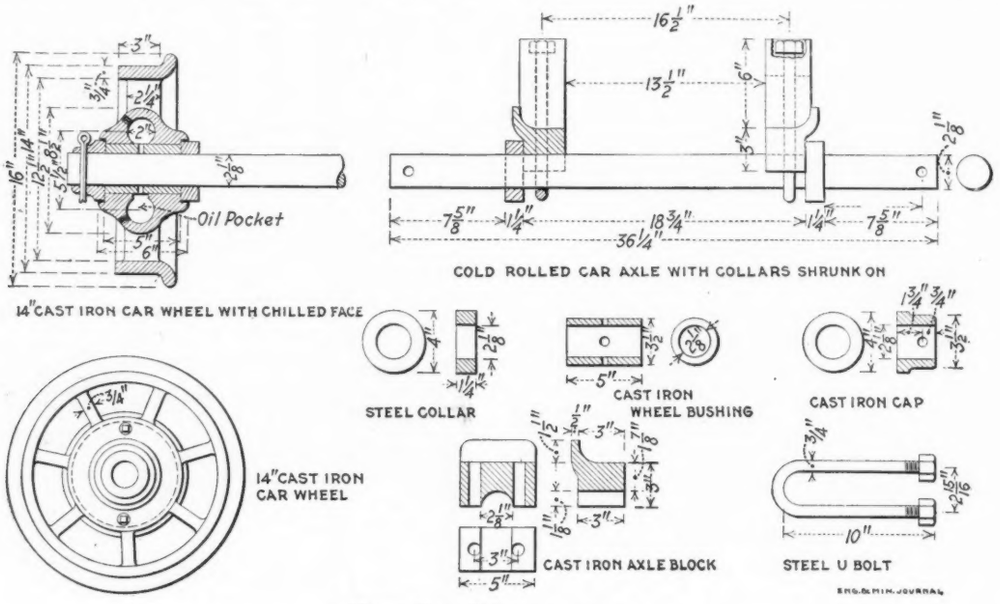
In conducting topographic surveys in connection with the reclamation of swamp and overflowed lands along the Mississippi and Illinois Rivers, instead of sketching the work in the field book, as is common in topographic work, sketch sheets 8½x11 in. were used on a board which would take four of these sheets at one time (*Engineering News,* Feb. 20, 1913; abstr. paper by Walter A. Birket, before Ill. Soc. of Eng. and Surv., Chicago, Jan. 22-24). The board was rounded out to fit a man at the waist, and had a strap from the outside corners passing over the shoulders. This enabled the topographer to work on the board while standing, and also to compare the sketches with the territory while walking over it. The observations taken by the instrument man were recorded in a field-book and also plotted with a half-circle stadia protractor on the sketch sheets by the topographer. The sketches were made to a scale of 1 in. to 400 ft. (the same as the finished drawings). With the shots plotted on the sketch sheets in the field, it was possible to sketch a great deal of the work which would have to be taken by shots if less reliable sketches were used. Enough contours were drawn on the sketches so that they could be used as a guide for the finished maps.

The advantages of this method are: (1) The work is plotted in the field; (2) the work is plotted from the balanced notes: (3) a draftsman who has never seen the territory can finish up the maps from notes and sketches and contour them correctly. The advantage over the plane-table is that the transit sets higher and therefore looks over a great deal of vegetation that would have to be cut if a plane-table were used. Work can be done more rapidly with a transit than with a plane-table. With the sketch method it is not necessary to take more than 75% of the shots that would be necessary with the ordinary stadia method. Sometimes with the latter method the territory is not covered and sometimes it is covered twice. With the sketch method, the topographer is able to tell at all times just how closely the territory is covered.

❋

Wheel and Axle for Mine Car

The car wheel and axle shown in the accompanying drawing is a serviceable type described by H. L. Botsford, Creighton Mine, Ont. The wheel and axle are designed for use with wooden trucks, but with slight modifications could be used with steel trucks. The wheels are fitted with renewable cast-iron bushings.


Oil Pocket
14"CAST IRON CAR WHEEL WITH CHILLED FACE
COLD ROLLED CAR AXLE WITH COLLARS SHRUNK ON
STEEL COLLAR
CAST IRON WHEEL BUSHING
CAST IRON CAP
14"CAST IRON CAR WHEEL
CAST IRON AXLE BLOCK
STEEL U BOLT

MINE CAR RUNNING GEAR

❋

Seasoning Timbers

The U. S. Forest Service in *Bull.* 108 remarks that in general, timber 8x16 in. in cross-section must be seasoned through two entire summers before reaching a thoroughly air-dry condition. If seasoning is started in the hot summer months, the loss of moisture is at first very rapid, and checking is invariably induced. The best results are obtained when the air seasoning is started in the late fall or early winter months. The effect of shrinking in redwood timbers is not very noticeable, although it contains much moisture when cut. It can therefore be seasoned readily without serious checking.

❋

A Three-ton Girod Electric Steel Furnace is to be installed in the steel-casting department of the Washington Iron Works, manufacturers of mining and marine machinery, Seattle, Wash. This is said to be the first electric steel furnace on the Pacific Coast.

DETAILS OF METALLURGICAL PRACTICE

Clean Ore Formula for Sudbury Ores

SUDBURY CORRESPONDENCE

The typical ore of the Sudbury, Ont., nickel-copper deposits is pyrrhotite, with from 3 to 6% of metallic nickel and copper as sulphides, the whole forming a 100% insoluble material. The characteristic gangue is norite, an eruptive rock of the gabbro type. This gangue is partly soluble, usually 20 to 25%. The ore often occurs mixed with the norite and the problem of computing the various percentages of the metallic components of the "clean ore" contained in a sample of "mixed ore" is of importance in the grading of the ore. A formula to meet this condition has been worked out as follows: Divide the insoluble in an assay by the factor of the insoluble in the gangue, usually 75 to 80%, and subtract the quotient from 100. The result is the per cent. of "clean ore," that is, of pyrrhotite and of copper and nickel sulphides in the mixed ore. The percentages of nickel and copper having been determined for the "mixed ore" sample, the respective percentages in the "clean ore" can be computed arithmetically. Thus, one assay of "mixed ore" gave: Insoluble, 48%; nickel, 1.0; copper, 2%; 48 ÷ 80 (the gangue insoluble factor) equals 60; 100 minus 60 equals 40, the percentage of clean ore in the sample. 1 ÷ 0.40 = 2.5, the percentage of nickel, and 2 ÷ 0.40 = 5, the percentage of copper in the "clean ore." This method is applicable, of course, only with a "mixed ore," in which the gangue is the characteristic norite, which is fairly uniform throughout the district, where found mixed with the ore. The presence of the foot-wall rock, usually greenstone, quartzite or granite, in any particular sample, of course, would vitiate the formula as applied generally for the mixed ore.

The percentages of the clean ore from some of the mines are so regular that at one of the treatment plants a chart is worked out, by which the determination of one of the ingredients of a sample is used to read the others from a charted table.

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Analysis of Lime

In using the "sugar" method for the valuation of lime for cyaniding purposes, which consists in treating a 2-gram sample with 1000 c.c. of a 2% solution of pure cane sugar, agitating thoroughly and titrating 50 c.c. with normal hydrochloric acid, it was found by Stanley and Wilkinson that the end point differed according as methyl-orange or phenolphthalein was used. Further investigations by J. Gray and Dr. J. Moir with various indicators led them to recommend (*Journ.* Chem., Met. and Min. Soc. of So. Africa, December, 1912), rosolic acid for this work as being the commonest of the successful indicators. The reason for the differences is believed to be the presence of so called neutral salts like calcium and magnesium sulphate in the sugar extract. Such salts are acid to phenolpthalein, and cause the results to be too low.

Melting Furnace at Rio Plata Mill

BY ALVIN R. KENNER*

The furnace used for melting at the Rio Plata mill, Guazapares, Chihuahua, Mex., has several features to commenced it over the usual type of pot furnace. This furnace originally contained four compartments, as shown in

METHOD OF POURING AT RIO PLATA MILL

Fig. 2, and was installed by A. F. Hughes, a former metallurgist of the company. Only the first two compartments worked at all, and these not efficiently, consequently the old furnace was dismantled and the furnace shown in Fig. 1 constructed.

The inner lining is of firebrick, backed by a red brick made of a rather poor grade of local clay of a highly siliceous character. The rest of the furnace is made up of the usual Mexican adobe and topped with a 1½-in. iron plate. The drawing shows a change in the design of the doors, which was suggested by A. W. Prior, a former metallurgist and superintendent of the company, and which it was intended to introduce whenever new doors became necessary. However, the present doors are still in good condition and the old method of handling them still in use. A bar extends along back of the furnace at a suitable height to be used as a fulcrum for the long

*General superintendent, Rio Plata Mining Co., Guazapares, Chihuahua, Mex.

two-pronged lever used in removing the doors. The prongs of the rod fit into two eyes in the top of the door and the latter is readily thrown in and out of position.

In firing the furnace, a layer of about three inches of charcoal is maintained in the first compartment, which requires a shovelful of fuel every five to 10 min. This was found to be much more economical and gave a much quicker melt than filling up the furnace around the crucible. With a small amount of charcoal thorough combustion of the gases is obtained, which probably accounts for the better results. When the furnace is full it is difficult to obtain a sufficient amount of air even with a forced draft, and the caloric value of all the fuel is not utilized. The grate bars are 1¼x1¼ in. in cross-section, and are spaced ¾ in. apart.

Many suggestions, based on the multiple-furnace idea as first installed by Mr. Hughes, have been offered as improvements on the furnace now used. These suggestions include many different arrangements of the baffle pieces, many different kinds of doors and several ways of reinforcing the grate bars. However, the tendency of these suggestions is to complicate the design, and simple construction is more desirable, both on account of cost and efficiency.

Two ideas which have never been suggested but which should add to the efficiency of the furnace now in use, are shown in Figs. 3 and 4. It is evident from observation of the flame as it enters the flue of the present furnace that a third crucible could be used without materially increasing the consumption of charcoal if the design in Fig. 3 were used and a slightly larger flue were constructed. The flue now in use consists of a 10-in. pipe, which is hardly large enough to create the proper draft and insure complete combustion. The obstruction, or wall, shown between the two crucibles in the longitudinal section of Fig. 1, is of little practical use. In fact, it is a drawback in that it causes the flame to strike the crucible at the middle instead of the bottom.

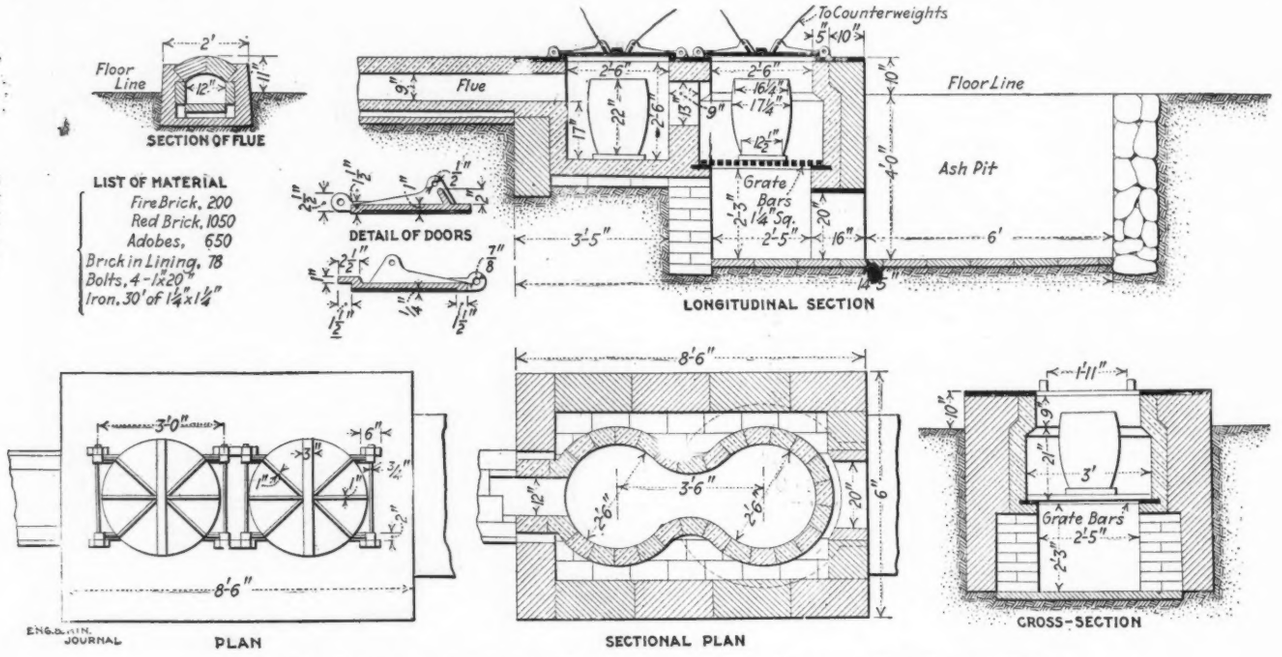


FIG. 1. CHARCOAL-BURNING MELTING FURNACE USED AT RIO PLATA MILL

A No. 300 Dixon crucible, placed on a seat made of two pieces of square iron (1¼x1¼ in. in cross-section) joined by pieces of ⅝-in. rod iron at the ends, is used in each compartment.

The second crucible is usually ready and always poured before the first. When the doors of the second compartment are opened, the draft draws air through them up the flue and there being no grates in the second compartment, the heat to which the smelter is subjected is considerably reduced and an objection to the usual type of pot furnace greatly modified. In pouring the crucible from the first compartment, a shovelful or two of fresh charcoal is scattered over the fire and the draft shut off. There being no charcoal or slag matted around either crucible, the tongs can be clamped quickly and securely.

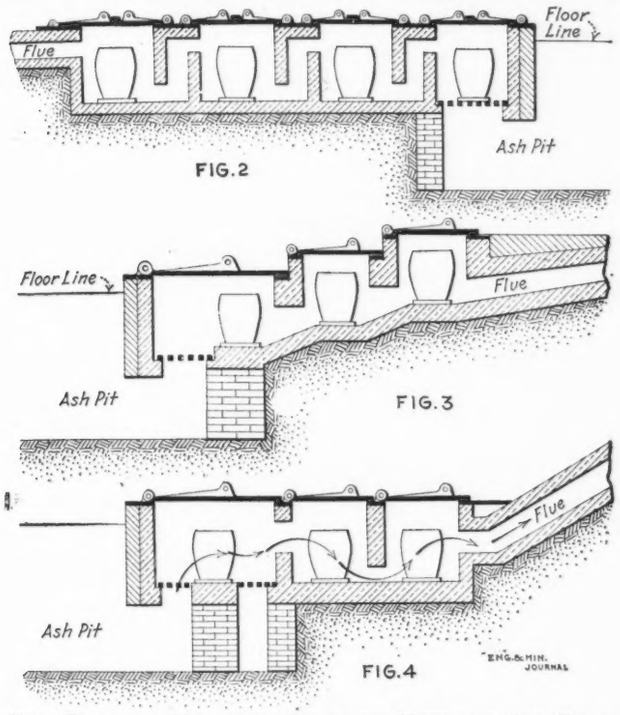
Each crucible when ready for pouring contains about 330 lb. of precipitate and flux. The capacity of the two compartments in 24 hr. is about 18 bars of silver, each weighing from 1100 to 1200 oz. and assaying better than 980 fine, or a little over 18,000 oz. of pure silver per day. Attention should be called to the high capacity obtained by the method of firing employed. In a recent melt of 140,000 oz., the fuel consumption was less than 50 kg. of charcoal per 1000 oz. of bullion.

The design in Fig. 3 overcomes this objection, as the flame will strike the lower part of the crucible and pass through the seat and underneath the crucible as well, in both the second and third compartments. In the first compartment, a hot flame is also obtained on the bottom of the crucible by placing the seat upon a solid base instead of upon the grate bars. More heat will strike the bottom of the pot so placed when resting upon an open seat than would be possible when the crucible is centered in the middle of the grate bars of the present furnace. For in the latter position, if an open seat is used, cold air coming through the grate strikes directly on the bottom of the crucible, and if a seat of some refractory material is used, this is also cooled by the draft and cuts off any direct contact of the heat with the under side of the pot.

Another advantage is secured by removing a weight of about 350 lb. from the grate bars, thus doubling or tripling their life. With the present furnace the grate bars must be taken out and straightened after every 80 or 90 bars.

Furthermore, lighter bars could be used and more air space obtained, which is an important consideration. The bottom of the furnace can be made horizontal or slightly inclined, as shown in the sketch. The method of handling the doors should be taken into consideration when selecting either design.

The furnace shown in Fig. 3 has never been tried out in practice, but its feasibility is assured, judging from the action of the furnace now in use. It has never been installed at Rio Plata because the saving that could be



OLD TYPE OF MELTING FURNACE USED AT RIO PLATA MILL AND SUGGESTED MODIFICATIONS

effected does not warrant tearing out the present furnace. The cost of new firebrick laid down at the mine is excessive, due to transportation over a long and difficult trail.

A second type of furnace that should work equally as well as the present furnace, is shown in Fig. 4. This is practically the same as the Noble petroleum melting furnace, the only difference being the changes that naturally suggest themselves when using charcoal instead of petroleum. The arrows in the sketch show the approximate path of the center of the flame.

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Converting Baume to Specific Gravity

A rule which will convert figures from Baumé degrees to specific gravity, and *vice versa*, is as follows:

140 ÷ (Bé.° + 130) = sp.gr. (approximately).

(140 ÷ sp.gr.) — 130 = Bé.° (approximately).

A Twaddell specific-gravity conversion is simple, as a Twaddell degree represents an excess of 0.05 sp.gr. over unity, hence:

$$1 + 0.05 \text{ Tw.}^\circ = \text{sp.gr.}$$

$$(\text{sp.gr.} - 1)\ 200 = \text{Tw.}^\circ$$

Lead Work in Metallurgical Construction

By H. T. DURANT*

In many metallurgical works, notably those connected with the wet metallurgy of copper and zinc, there is a considerable amount of lead work, comprising lead pipes and lead-lined launders and tanks. The lead used, whether in sheet or pipe, should be that which is usually known in the trade as "chemical lead," which is free from copper and zinc or other elements, which would in the presence of an electrolyte, set up a couple, and thereby cause failure and leaks at certain spots.

For a similar reason burnt joints are far preferable to wiped ones, for in the case of the latter the two metals, lead and tin, are in contact with the acid solutions and further than this, it will be found that wiped joints are often porous and will slightly leak or sweat. Another objection to wiped joints is the doubtful percentage of tin in some bought solders, though it is usual to make one's own solder where much wiping has to be done.

Lead burning should, for economic motives, be done when possible with compressed oxygen, instead of with atmospheric air; should coal gas also be available, then the necessity of wastefully generating hydrogen from zinc and acid is avoided. Generally speaking, plumbers who are accustomed to domestic or house work cannot be employed with economy in this class of work; it is more satisfactory to get lead burners, who have been trained at sulphuric-acid or similar works.

CARRYING PIPES

Lead pipes, owing to their irregularity, are liable to air locks, which must be guarded against. All lead pipes should, when in position, be carried on timber runners suitably hung or supported, and so that the weight of the pipe is borne evenly along the whole length—the pipe is partly encircled about every 6 ft. by a strap of lead spiked at each end to the timber; this holds it in position on its carrier. In the case of pipes up to 2-in. bore, set vertically or approaching the vertical, these lead straps should be burnt to the pipe and should be strong enough to prevent the downward creeping of the lead. Where larger pipes have to go up vertically, it is preferable to put the pipe in in flanged lengths, as the flanges form the most convenient means of taking the weight to prevent creeping or collapse of the pipe.

A pipe when hanging vertically and unsupported at its lower end, as in the case of a pump suction, elongates considerably unless the weight is properly taken by one of above mentioned methods.

Bends, elbows, etc., of above 2-in. bore are always best made flanged at each end. They can then be easily held to shape by a suitably bent angle iron, so that when coupling up, each end of the angle iron will engage with one of the flange bolts, and thus the angle iron will serve as a stiffener.

Lead pipes should not be buried unless unavoidable, and if buried they should be boxed or otherwise protected from any weight or pressure. The usual weight of pipes suitable for ordinary works purposes and capable of withstanding an internal pressure up to about 25 lb. per

*Mining and Metallurgical Club, 3 London Wall Buildings, London, E. C.

sq.in. is 10 lb. per yd. for every inch internal diameter.

Pipes, where permissible, naturally cost less than lead-lined launders, but the transport of lead pipes to any considerable distance is more costly than sheet lead, on account of the packing required. All pipes should be protected when placed in positions where they can be trodden on or otherwise damaged.

Flanges and Jointing

Subsequent to the construction period it will be found a great advantage if pipes have been laid flanged in convenient lengths. In general the flanged length of lead pipe should be of such a weight that it can be easily handled on its wooden runner by two men.

Small piping up to 2-in. bore is supplied in coils, containing about 60 ft., which are easily straightened out and rapidly laid; if this be done and the pipe is not laid in flanged lengths, the result is a saving of expense in construction, but an increased operating expense and trouble when the pipe gets blocked, or for any reason requires opening.

Flanges are easily cast from lead containing 8 to 10% of antimony; these conform to standard dimensions, but the minimum thickness of metal in the cast flange should be not much less than ½ in.; they are drilled as usual for coupling, and are sufficiently hard to be bolted up with bolts and washers without using any stiffening plate.

The flanges are burnt to the end of the lead pipe, the flange boss being cast slightly tapered inside so that the pipe seats well into it, and the burning is done so that the pipe is burnt to the flange at the outside of the boss, and again inside where the pipe goes almost through the flange.

Iron bolts can always be used for coupling up as they do not come in contact with acid or harmful solution; the flanges as cast only require a rough facing with a milling file. If a pipe in a system where joints are not flanged needs to be opened up, it must be sawed through, probably in the wrong place to start with, then joined again by burning or wiping.

Lining Tanks and Launders

The sheet lead required weighs, according to its service, from 7 to 10 lb. per sq.ft. Most lead rolling mills can turn out any width up to 7 ft. 9 in. It is an economy, especially in the case of launders, to get the lead the right width, as it saves time, labor, cutting and waste. It is obvious, though a precaution sometimes neglected, that all loose or projecting nails and wood splinters should be removed before the sheet lead is laid in position; similarly, any bolt heads should be countersunk and all dirt or anything which can wound the lead should be first removed; also workmen on the job should wear slippers, or at least not boots.

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Wood Floors on Concrete

Where a hardwood floor is required over a concrete slab, the common way is to lay beveled screeds about 12 or 15 in. on centers, bed these in cinder concrete, over them lay a 1-in. or 2-in. rough floor, and on top of this lay the hardwood, ⅞-in. as a rule. The Aberthaw Construction Co., Boston, has laid an excellent hardwood floor on a Government job by putting down ⅞-in. form lumber on top of the rough concrete, laid diagonally to the finished floor and on top of this nailing the hardwood.

It is much better to have the hardwood square edge than tongued and grooved. Then if the floor boards warp the edges do not split and if repairs are necessary, a board can be taken out without ruining the floor around it; also, the boards will wear better when square edged than when grooved.

The boarding should be laid the way of the greatest traffic, that is, trucking should not run at right angles to the floor boards if this can be avoided. When the progress of traffic is definite, it will pay to change the direction of the boarding where the turn in traffic comes. For wet floors, the Aberthaw Construction Co. does not use maple, since it finds that rift hard pine, which is full of pitch, is much better. There are preparations sold for preserving wood floors from the effect of wetting which are worthy of investigation.

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Economical Tank Connection

The illustration shows a simple arrangement of piping and fittings for a tank which automatically prevents overflow, and at the same time uses only a single pipe for both supply and discharge.

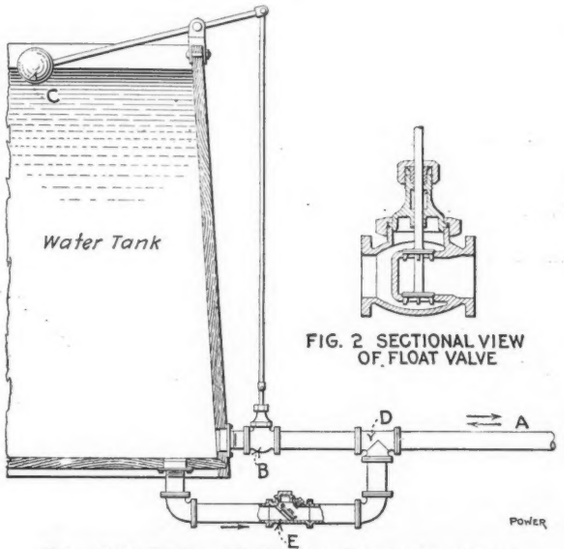

FIG. 1 SINGLE PIPE AS SUPPLY AND DISCHARGE LINE OF WATER TANK

FIG. 2 SECTIONAL VIEW OF FLOAT VALVE

Referring to Fig. 1, the pipe *A* extending into the tank carries a balanced lever valve *B* operated by the float *C* in the usual manner. Obviously with the float valve alone, *A* could not be used for discharge after the float has closed the valve unless other means were used to open it.

To overcome this difficulty, writes W. S. Mayers in *Power*, Feb. 25, 1913, the tee *D* is inserted and a bypass run into the tank, as shown. In the bypass there is a check valve *E* so placed that the water can flow from the tank, but not in the reverse direction.

When the water reaches its highest level in the tank both valves will be closed. If now the source of supply is cut off and an outlet from the pipeline opened, the pressure will fall at the discharge end of the check valve, and the water will flow freely through the bypass as well as through the float valve when the float has dropped sufficiently to open it. In Fig. 2 is shown a sectional view of the float valve.

NOTES FROM CURRENT LITERATURE

High Tension Direct Current Transmission

The transmission of about 20,000 kw. a distance of 200 miles at a tension of 90,000 volts is nothing out of the ordinary. But the fact that this transmission crosses a salt-water strait and is effected by using a direct current is almost unique. The system as described in *Electrical World,* Feb. 8, 1913, comprises a generating plant at Trolhättan, Sweden, with a transmission line to Copenhagen, Denmark. Careful investigations by engineers led to the adoption of the Thury direct-current system with a ground return. This was chosen as against the usual three-phase transmission by alternating current at 100,000 volts, the advantage lying in the great simplicity of the insulation problem. To cross the strait of Oresund, in order to get into Copenhagen, would have required stepping down the alternating current to 20,000 volts. The strait is nearly 3½ miles wide; but submarine cables can actually be obtained for a 90,000-volt direct current. Worked out in detail, the direct-current generating plant was more expensive by 40 or 50%, owing to the necessity of using more units and of a more expensive type. But in the transmission line the tables were completely turned, and in the total first cost the direct current had an advantage of nearly 25%; while in operating cost the estimated annual expense for direct-current transmission was $6.75 per kw. as against $12.43 per kw. for the three-phase type. In addition to this the alternating current necessitated more transformations and consequently yielded less power delivered at the consuming end.

Fireclay Deposits of Canada

With the rapid development of Canadian industries calling for the use of firebrick, the question has often arisen whether the Dominion itself has not the necessary raw materials for the manufacture of such refractory wares, says Heinrich Ries in a paper presented before the October, 1912, meeting of the American Institute of Mining Engineers.

The imports of such products in Canada in 1910 amounted in value to $519,454, coming in part from Great Britain, and part from the United States.

During the last four years an investigation for the Canadian Geological Survey has resulted in a report on the existence of beds of refractory clays at the following localities: Inverness and Shubenacadie, Nova Scotia; St. Remi, d'Amherst, Quebec; Dirt Hills and Cypress Hills, Saskatchewan; Sumas Mountain, near Clayburn, B. C., and Kyuquot, on northwestern Vancouver Island. It is possible that other deposits may be discovered in the future in districts at a distance from the present lines of railroad.

Of the occurrences mentioned only those of Sumas Mountain and Kyuquot are at present utilized. The vast deposits of the Dirt Hills are still attractive for development. A fact which enhances the value of some of these deposits is that they are adapted not alone to the manufacture of firebrick, but can in some cases also be worked for use, wholly or in part, in the production of stoneware, terra cotta and sewer pipe.

The Deepest Borehole in the World?

Near Czuchow, in Silesia, according to *The Mining Journal,* a borehole has been sunk to a depth of 2240 m.; the time required for its completion was 982 days. The first 53 m. were bored by auger, the next 523 m. by chisel (churn drill), and the rest by diamond drill. More than 700 carats of diamond were used up. The total cost of the bore was 300,000 marks (about $72,900). It was expected that the coal measure, the depth of which was to be ascertained by the bore, would be struck at 1500 m., and the original diameter of the hole was made in accordance with that assumption, but when that depth was exceeded, the hole had to be widened, causing a great deal of extra work, which unfavorably affected the cost as well as the length of the working period. Other boreholes of great depth have been sunk in Germany at from 60 to 80 marks per meter. The rods were constructed of Mannesmann tubes of different diameters; the 2000-meter running length of the tubes weighed 14,200 kg. At 500 m. depth the temperature was 26° C.; at 1000 m., 40°; at 1500 m., 69°; and at 2221 meters, 83.4 deg. Centigrade.

The Composition of "Niccolite"

In the course of a series of experiments on the precipitation of gold and silver by metallic minerals, described by Chase Palmer and Edson S. Bastin, before the February meeting of the American Institute of Mining Engineers, a silver-sulphate solution was treated with niccolite, having the composition: Ni, 28.26%; Co, 12.25%; Fe, 0.46%; As, 53.02%; S, 5.89%. Weighed quantities of the finely powdered mineral, niccolite, were digested in dilute silver-sulphate solutions containing known amounts of silver sulphate. Action began promptly. Silver was deposited and the solution became green. After the lapse of several hours the gray residual mineral, together with the silver deposit was collected on a filter. After deducting the weight of the silver the mineral residue was found to represent 35.12% of the niccolite treated, having a composition: Co, 34.9%; Fe, 1.3%; As, 47.1%; S, 16.7%. This corresponds to the formula for cobaltite, namely CoAsS. The portion of the mineral dissolved by the silver sulphate solution consisted only of nickel and arsenic. The nickel amounted to 28.26% and the arsenic 36.50% of the original niccolite. Since these results correspond to one atom of arsenic for every atom of nickel dissolved, it is apparent that the material attacked by the silver-sulphate solution is true niccolite (NiAs). The arsenic was present as ar-

senious acid. The weight of silver deposited with the residual cobaltite amounted to 260.1% of the weight of the niccolite treated. Since the dissolved niccolite, dissolved arsenic, and deposited silver are proportionally: Nickel, one atom; arsenic, one atom; and silver, five atoms, the reaction between niccolite (NiAs) and dilute silver-sulphate solution may be expressed by the equation

$$2\ NiAs + 5\ Ag_2SO_4 + 3\ H_2O = 2\ NiSO_4 + As_2O_3 + 3\ H_2SO_4 + 10\ Ag$$

Thus the so called niccolite may be regarded as consisting of 64.76% of true niccolite and 35.12% of true cobaltite. Microscopic study of a polished piece confirmed the conclusion that it is a mixture of two minerals, but evidently silver-sulphate solution may be used advantageously to throw light on the nature of certain complex minerals for by its agency two distinct mineral species were thus quantitatively separated.

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Gold Mining in Portuguese East Africa

The territory of the Compañia de Mocambique, in Portuguese East Africa, is little prospected and little developed. The greatest amount of work has been done in the neighborhood of Macquece (Massi Kessi), where ancient, alluvial gold workings exist. This place is on the railroad, 183 miles from the port of Beira; no duty is charged on mining supplies, according to *South African Engineering,* January, 1913. Mining costs are said to be 11s. per ton when using water power. Native labore is supplied by the Mozambique company. Such labor is paid from $4.75 to $8.25 per month. The company receives a royalty varying from 1 to 4% on the value of the gross output of properties producing less than 800 oz. of fine gold monthly; and operators producing more than 800 oz. pay a tax of 10% on net profit. Water and wood for timbering are free, except for the payment of a light fee, and for fuel-wood a small charge is made.

In 1911 the lode mines produced about $60,000 worth of gold, the chief contributors being the Guy Fawkes, the Chimezi and Rhodes Banket and the Central Welcome. The report of the Compañia de Mocambique states that while mining declined somewhat in 1911, due to the suspension of operations by the Edmundian copper mine and the Braganca-Richmond gold mine, on the other hand, 14 stamps were added to the total number on gold-bearing properties, bringing the total up to 85, and a new company, the Andrada Mines, Ltd., was formed and took over the claims of the Mozambique Mines, Ltd. This company is planning development and exploration work on a large scale, including prospecting of alluvial deposits. It is stated that two dredges will be constructed.

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Variation in Recalescence Temperature

It is known that the temperatures of recalesence of uniform samples of steel vary inversely as the temperatures to which the various samples have been raised. A possible analog and partial explanation was given by Dr. Henry M. Howe at the meeting of the American Institute of Mining Engineers, February, 1913. If substances, which, when melted, yield liquid crystals, are heated barely high enough to turn the crystals into an isotropic mass, and are then cooled, the identical crystals reappear. If heated to a much higher point, the crystals are not the same. In the first case it is evident that the nuclei of the crystals persist. It seems possible that if iron be heated just above its recalescence point, the original structure persists to some extent, and recalescence takes place easily; if heated to higher points, the structure becomes more and more broken down, and more and more under-cooling is necessary to bring about recalescence.

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The Nature of Bornite

The exceedingly variable chemical composition of bornite, as found in nature, has long been responsible for the suspicion that it rarely occurred pure. This belief has been confirmed by examination of polished sections, according to Graton and Murdock, in a paper on "the sulphide ores of copper," presented before the February meeting of the American Institute of Mining Engineers. The common intimate intergrowth of primary bornite with other copper or copper-iron sulphides, and the readiness with which bornite suffers a general chemical breakdown to form products likewise closely related to it in composition, unite to prevent the common occurrence of masses of pure bornite of any appreciable size; yet the common development of the primary intergrowths and of the secondary-alteration products on a scale only microscopic disguises this fact. In consequence, much bornite that appears to the eye, or with the pocket lens, to be practically pure is found to contain one or more other minerals in amounts even up to 50%. This condition is so general that it is safe to conclude that the great majority of analyses of bornite have been made upon material of various degrees of impurity; and it is not surprising, therefore, that these analyses show wide variations and that the formula for the mineral is still in doubt. Whether pure bornite is constant or variable in composition cannot be known until analyses have been made of pure material from several localities.

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The Elk City District, Idaho

The Elk City district of Idaho is situated in Idaho County, and is reached by way of Stites, the terminus of a branch of the Northern Pacific Ry. The district comprises some 350 square miles and is primarily a gold-producing region. There was an important production in the past by placer operations. At present five mills are operating, said Arthur L. Flagg, in a paper presented at the February meeting of the American Institute of Mining Engineers. The Elk City Mines Corporation of Spokane operates a five-stamp plant with a James table. They expect to install soon, a new 10-stamp mill. The Buster mill is now treating ore from the Mineral Zone mine. It consists of 10 stamps, plates, six vanners and a 40-ton cyanide plant. A one-stamp mill has been operated on the Little Butte property, and the Last Chance mill, of three stamps, works intermittently. About 20 tons is handled daily in the 3½-ft. Huntington mill of the Mascot plant. The American Eagle mill is expected to be started again soon. A custom plant erected in Elk City by public subscription has not been successful. There is more or less activity in the district at present, but the accumulated prejudice of past "wild-catting," acts as a drag on the progress of really meritorious enterprises.

The Canadian Mining Institute

SYNOPSIS—The 15th annual meeting of the Canadian Mining Institute convened at Ottawa on Mar. 5. During the three-day meeting, many interesting papers were read and special entertainments provided for the evenings. Dr. A. E. Barlow was reëlected president of the Institute.

The Canadian Mining Institute held its 15th annual meeting at the Château Laurier, Ottawa, Ont., on Mar. 5, 6 and 7, and as usual the meeting was well attended both by Canadian and American members, although perhaps there were fewer of the latter than usual. The custom of the Canadian Mining Institute in holding its annual meeting in one of the important capitals of Quebec and Ontario, where excellent hotel accommodations are available, promotes sociability, and in bringing its members together in so intimate a way is very effective in increasing the strength of the organzation.

Doctor Barlow's Presidential Address

The first session of the 15th annual meeting was opened on Wednesday morning by Field-Marshall His Royal Highness, the Duke of Connaught, Governor-General of the Dominion of Canada. Dr. A. E. Barlow, president of the Institute, presided and delivered the presidential address, the theme of which was the status of the mineral industry of Canada and its future. In connection with this, Doctor Barlow referred to the rapid growth of the Institute and its present flourishing condition. He intimated, however, that more aid from the government would be useful. Doctor Barlow, in pointing out the importance of the mining industry in Canada, stated that this industry was greater than the forestry and fishing industries combined.

The usual reports of the council and of the treasurer of the Institute were presented. Also, as is usual at this meeting, the mineral statistics of Canada for 1912 were laid before the membership of the Institute by John McLeish, of the Department of Mines, Ottawa; T. C. Denis, Superintendent of Mines, Quebec; Thomas W. Gibson, Deputy Minister of Mines, Toronto; and W. Fleet Robertson, Provincial Mineralogist of British Columbia. The early presentation of these statistics is highly praiseworthy.

The reëlection of Doctor Barlow as president of the Institute was announced. The remainder of the morning session was devoted to general business. A resolution which provoked a lively discussion was offered by Col. J. J. Penhale, of Sherbrooke, Que., calling for an independent department of mines under its own minister in the Dominion government. This drew out much adverse expression of opinion. It was pointed out that the Canadian mining industry had at present substantially all that the resolution asked for, and that it was mainly at the instance of the Institute that the Hon. Louis Coderre had been appointed minister of mines, his other duties as secretary of state being not so numerous as to prevent his paying proper attention to the mining industry. Dr. W. G. Miller moved that all the words in the resolution after the word "resolved" be struck out, and his motion was emphatically carried.

The list of papers scheduled for the meeting was as follows:

"Mica Mining in Canada." By Hugh De Schmid, Ottawa, Ont.

"Mica Manufacturing and Marketing." By S. O. Fillion, Ottawa, Can.

"The Origin of Graphite." By John Stansfield, McGill University, Montreal, Que.

"The Evolution of Mining and Milling of Asbestos in the Eastern Townships of Quebec" (illustrated with lantern slides). By J. J. Penhale, Sherbrooke, Que.

"Some Early Experiments in Oil and Grease Concentration." By H. E. T. Haultain, Toronto, Ont.

"The Development and Problems of the Yukon" (illustrated with lantern slides). By H. M. Payne, New York.

"Cyanide Practice in Canada." By Herbert A. Megraw, New York.

"The Treatment of Gold Ore at the Dome Mine, South Porcupine, Ont." By C. W. Merrill, San Francisco, and D. L. H. Forbes, Toronto.

"Some Notes on the Pearl Lake Section of the Porcupine District." By H. G. Skavlem, Aura Lake, Ont.

"Grading Analyses, and their Application to Cyanidation." By John W. Bell, McGill University, Montreal.

"The Measurement of Compressed Air Delivered by the Hydraulic Compressor at Cobalt." By C. H. Taylor, Toronto.

"Recent Advances in our Knowledge of the Sudbury Region." By A. P. Coleman, Toronto, Ont.

"Notes on Mine Sampling." By G. C. Bateman, Toronto.

"Agglomeration of Iron Ores" By N. V. Hansell, New York.

"Prospecting the Iron Sands of Natashkwan, Quebec, with the Empire Drill." By G. C. Mackenzie, Mines Branch, Department of Mines, Ottawa.

"The Iron Resources of the Province of Quebec." By E. Dulieux, Montreal.

"The Steel Industry of Nova Scotia." By Thomas Cantley, New Glasgow.

"Iron Mining in Cuba." By Charles F. Rand, New York.

"Explosives in Mining." By F. H. Gunsolus, Wilmington, Del.

"Some Notes on Monel Metal." By William Campbell, Columbia University, New York.

"Preliminary Experiments on the Metal Cobalt and its Alloys." By H. T. Kalmus, Kingston, Ont.

"Magmatic Origin of the Sudbury Copper Deposits." By Reginald E. Hore, Houghton, Mich.

"The Rice Lake Gold District, Manitoba." By Robert C. Wallace, University of Manitoba, Winnipeg.

"Investigations of the United States Bureau of Mines in Metal Mines." By George S. Rice, Pittsburgh, Penn.

"State Aid to Mining in Australasia." By H. Mortimer Lamb, Montreal.

"The Clay Deposits of Western Canada." By Heinrich Ries, Cornell University, Ithaca, N. Y.

"The Geologist." By H. E. T. Haultain, Toronto, Ont.

"An Economic Investigation of the Coals of Canada." By J. B. Porter, McGill University, Montreal.

"The Lignites of Saskatchewan." By R. O. Wynne Roberts, Regina, Sask.

"Prospecting and Washing for Diamonds." By W. J. Dick, Ottawa.

"Core Drilling." By P. H. Moore, Toronto, Ont.

"Utilization of Exhaust Steam at Collieries and Mines." By J. M. Gordon, Montreal, Que.

"Recent Metallurgical Developments." By Alfred Stansfield, McGill University, Montreal.

"The Pulmotor in Mine Rescue Work." By Henry E. Bertling, Toronto.

Not all of these papers were presented at the times scheduled. Indeed, there was extensive departure from the schedule. Nor were any of the papers especially the subject of discussion.

Yukon Night

At the Wednesday evening session the chair was occupied by Dr. Alfred Thompson, M. P., of Dawson, Yukon Territory, who delivered an address on "The Progress of Mining in the Yukon," and introduced the speaker of the evening, Dr. Henry M. Payne, of New York, who described the "Development and Problems of the Yukon," his lecture being illustrated with lantern slides.

The special feature of the session on Thursday afternoon was a description by Dr. James Douglas of an expedition of two of his nephews and a companion to the Coppermine River district, in the Arctic region. Doctor Douglas exhibited photographs taken by the explorers and described their journeyings. The main purpose of the expedition was to determine the existence of copper in that region, stories of which have long been prevalent. The expedition found geological formations that are supposed to be very similar to those of Lake Superior. While no immediate promising deposits of copper were found, the region is, in the opinion of Doctor Douglas, worthy of exploration as a mining region. Prof. L. C. Graton followed Doctor Douglas, showing slides of rocks from Coppermine River country, and in comparison therewith rocks from the Lake Superior region, the similarity being striking.

"The Stinging Wildcat of Cobalt"

The session on Thursday evening was devoted to a smoking concert, the feature of which was a play presented and acted by members of the Canadian Geological Survey, the program being as follows:

THE MINING WORLD

—or—

THE STINGING WILDCAT OF COBALT!

DRAMATIS PERSONAE

Professor Pickrock, the loquacious expert,
C. H. CLAPP

Dr. Highbrow, the mutable expert,
A. G. HAULTAIN

Comte de Suckier, employed in the interests of Parisian capital,
O. E. LeROY

H. Bluffmuch Jones, Esq., English mining expert, recommended to MacSkinyer by G. G. S. Lindsey,
ALEC DICKISON, Esq.

Jock MacSkinyer, Scottish Jew and claim owner,
E. E. FREELAND

Kerry Ulster, of doubtful nationality, but of wide experience in many nations; now filling the chair of alcoholics temporarily,
W. H. BOYD

Hashie Slinger, the hotel do-all,
K. G. CHIPMAN

Miners, prospectors, mob, and other amphibians

SCENE: Cobalt, Ontario—Hotel and Plaza

Metallic Cobalt and Its Alloys

The chief feature among the papers of Friday morning was the statement by Dr. H. T. Kalmus, of Kingston, Ont., respecting his experiments with the metal cobalt and its alloys. He has found it very easy to obtain metallic cobalt and also has found that the properties of the metal vary greatly according to its freedom of sulphur, even when the latter amounts to only a few tenths of a per cent. Pure cobalt has remarkable properties which are likely to render it a commercially useful metal. Among other things it is unaffected by oxidizing influences, gives cutting tools of great hardness, is of excellent appearance, and possesses very great tensile strength. Doctor Kalmus' experiments with this metal are being made under the auspices of the Canadian Department of Mines, of which Dr. Eugene Haanel is director.

The Geologist and the Mining Engineer

The feature of the session of Friday afternoon was a paper by Prof. H. E. T. Haultain, on "The Geologist." At the meeting at Toronto a year ago, Professor Haultain made some caustic remarks respecting what he conceives to be the undue appreciation of the geologists and the relative depreciation of the mining engineers. His remarks at Toronto provoked a rather hot discussion, and consequently it was expected that his continuance of the subject at Ottawa would be an occasion for the display of some fireworks, which naturally drew out a large attendance at this session. Professor Haultain presented an interesting paper, following which there was some discussion, but all of it was of a very tame nature. In concluding his discussion, Professor Haultain remarked that he had put too much jam in his paper and that the geologists had eaten the jam and disregarded the rest.

The annual meeting concluded with the usual banquet on Friday evening. A unique feature of the menu was its presentation in the form of a mill flow-sheet. The guests of honor were the Right Honorable Richard L. Borden, Prime Minister of Canada, and Sir Wilfred Laurier, ex-Prime Minister, both of whom delivered appropriate addresses. Dr. A. E. Barlow presided at the meeting and G. G. S. Lindsey served as toastmaster.

Tennessee Copper Co.

At the recent annual meeting of the Tennessee Copper Co., the 141,000 shares represented (200,000 outstanding) were voted in favor of James Phillips, Jr., as president, and for Walter M. Briggs, Mr. Phillip's son-in-law, as secretary and treasurer. The directorate will also be in accord with these new officials. Besides the officers mentioned above, the new board of directors include: Sidney J. Jennings, W. B. Thompson, Felix Rosen, Alexander Peacock, Utley Wedge, George W. Breen, William Nerreamer, E. H. Westlake, Joseph Walker, Jr., Richard Sutro and Horace M. Kilborn; the last three entered the board a year ago. It is probable that two directors representing important financial interests will be elected at the next meeting of the board.

The company produced last year 13,252,634 lb. of copper from its own ores and 4,406,423 lb. from custom ores; the silver recovery was 50,622 oz. and gold, 337 oz. The sulphuric-acid plant operated continuously, except 15 days during the summer, and produced 192,084 tons of acid. The company's bonded indebtedness was reduced to $1,200,000. Besides paying $150,000 on this account, $100,000 was added to the reserve for plant depreciation and $50,000 for a special depreciation fund, and $150,000 was added to the surplus reserve account.

The company is now producing about 500,000 lb. of copper per week from its own and custom ores, and about 600 tons of sulphuric-acid daily, which is said to be the largest production of acid from any single plant. It is expected that the company will shortly be placed on a regular quarterly-dividend basis. The new management will also take up at once the matter of treating the Eureka ore on a commercial scale. In the Eureka mine, there is reported to be already developed 2,500,000 tons averaging 44% Fe, 36% S and about 1% Cu. This ore is to be treated primarily for its iron and sulphur and has been the subject of experiment for some time; it is now planned to erect an initial unit to try out the process suggested. This, if successful, will give the company a new product, a nonphosphorus iron ore, and may lead to an iron-furnace operation, if a ready market is not found for the intermediate product.

Wettlaufer Lorrain Silver Mines, Ltd.

The report of the Wettlaufer-Lorrain Silver Mines, Ltd., operating on the South Lorrain district, Ontario, for the year ended Dec. 31, 1912, shows that no new good ore discoveries have been made and that if no orebodies are opened up soon, shipping must cease in from three to five months. After payment of the regular dividend in January, of $70,829, the company will have enough funds to carry out the prospecting and development work as now outlined by the consulting engineer, but regular dividends must be discontinued.

An option has been taken on the Williams property and this is now being prospected. Work was also done on the Keeley and Silver Eagle claims during the year. About 170 ft. of drifting was done on the Keeley, but as the results were discouraging the option on the property was abandoned. On the Silver Eagle, 243½ ft. of raising and drifting was done, but the option on the property was not exercised.

Ore reserves were estimated at about 1,000,000 oz. on Dec. 31, 1911, and on Dec. 31, 1912, were estimated at 125,000 oz. Development work during the year amounted to 1998 ft. The production was 172.15 tons of high-grade shipping ore, 119.92 tons of low-grade shipping ore, and 219.16 tons of concentrate, and 1173 lb. of bullion, in addition to which on Jan. 1, 1912, there were 20.77 tons of high-grade shipping ore on hand. The total shipments amounted to 477.7 tons of ore and 673 lb. of bullion, carrying 850,998 oz. of silver, while there are now 54.81 tons of ore and 500 lb. of bullion on hand, carrying 79,089 oz. of silver.

The development scheme spoken of above outlines a comprehensive plan by which every portion of the property will be searched where there is a chance of finding further ore. The high-grade ore is practically gone, the mill is working on stope filling, and it is apparent that unless new ore is discovered, the end of the mine is in sight.

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Open Pit Mining in Joplin District

By Lucius L. Wittich*

Open-pit mining operations are becoming common in the Missouri-Kansas-Oklahoma zinc and lead district; especially in the older camps, where early-day methods resulted in caving ground, has the open-cut system proved both popular and profitable. Where a steam shovel can be employed in the open pits, thus supplying a great tonnage of ore at comparatively small expense and where a concentrating plant of large tonnage can be kept running steadily on the ore thus produced, it is surprising to note the thinness of the ground that can be worked successfully. At certain places in the district the mill recovery is less than 1%. Operations could not be conducted at

Fig. 1. Open-pit Mine Near Webb City, Mo., Now Being Operated by Minor Heir-Vantage Mining Co. The Small Drifts Near the Top of the Pit and the Large Cave in the Center Are Evidence of Early-day Gouging Methods

*Joplin, Mo.

a profit in such cases, of course, were it not for the high price of blende, the chief mineral product of the district mentioned, which is now selling for $50@57 per ton, assay basis of 60% metallic zinc, while choicer grades run as high as $60 per ton.

Gouging Employed in Early Days

In the early days of the camp only the richest ore deposits were worked. To have mined ground that carried only 5 or 6% blende and galena would have been considered the height of folly. Pockets and runs that were almost pure mineral were gouged out and the product treated on hand jigs, when necessary; although in many instances, especially in the mining of lead, the mineral was ready for the smelter when taken from the ground. With the advancing years larger drifts were cut and thinner ground was mined.

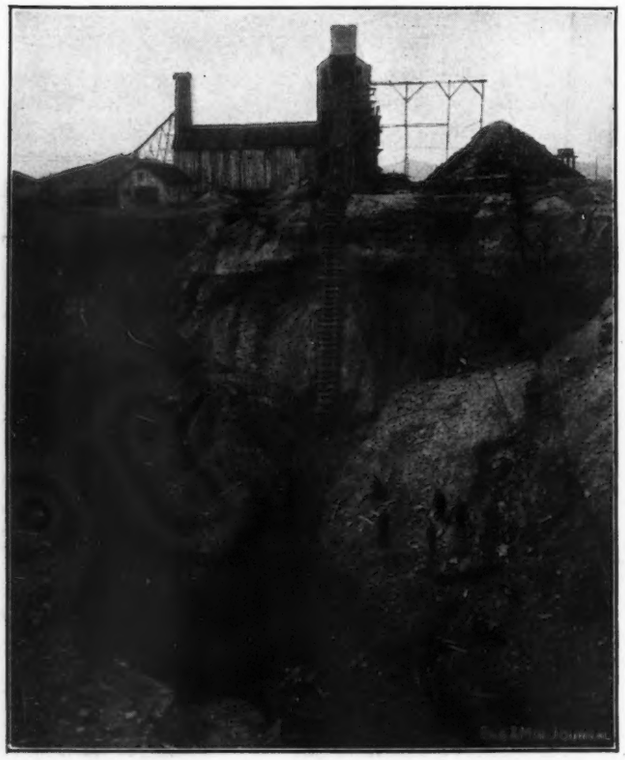

Fig. 2. Incline Tramway of Minor Heir-Vantage Company for Hoisting Ore from Open Pit to Concentrating Plant

An accompanying halftone furnishes an interesting study of the different epochs of mining development. This is a picture of the new open-pit mine of the Minor Heir-Vantage Mining Co., situated north of Webb City, Mo. Here may be detected the evidences of the various stages of development: First, the early-day gouge, barely large enough to accommodate the body of a large sized prospector; second, the spacious, arched drift, which was cut so large that it eventually caved in, and third, the great, open pit from which the dirt is now being milled from the surface down, loaded into cars and hoisted up an inclined tramway to the concentrating plant above, as shown in the second illustration. The first illustration is a view looking toward the east; the second toward the west.

In the first illustration, several of the early-day gouges will be observed near the top of the sheer face of the pit. Slightly to the left of the center an old shaft that was sunk only to the river-gravel stratum will be observed. In former years it is presumed that Center Creek, a small stream which now flows some distance to the north, passed over this property and a stratum of river gravel, several feet in thickness, was left. This gravel contains galena nuggets rich enough to have induced prospectors to sink shallow gouges into the formation and hand jig the output. To the right of the center, and just beneath the stratum of gravel, another small opening is observed. This also was in a shallow run of galena. Above the gravel stratum will be noted a layer of "made soil," several feet in thickness, which represents the accumulation from old mining operations and which carries a fair percentage of fine ore. At the upper right of the picture is seen an old boulder heap, carrying 1 to 2% in blende. All of this ground will be blasted into the pit and will find its way to the mill. The pit is 135 ft. in depth to the level of the water in the large, dark opening near the center of the picture. To the right of this large opening is seen a slab of solid rock and earth, which fell from the side of the pit and which will be milled. This single slab is larger than an ordinary cottage.

Herreshoff's Method of Cooling Reverberatory Bottoms

In U. S. pat. No. 1,047,521, issued to J. B. F. Herreshoff and assigned to the Nichols Copper Co., a method is described looking toward the efficient cooling of reverberatory-furnace bottoms. As ordinarily laid, a reverberatory bottom consists of a sand bed more or less thoroughly vitrified before use, laid on top of the brick bottom, which is in turn supported on iron plates resting on short pillars, which stand in the so called vault, a clear space through which air is allowed to pass when the furnace is operating. The cooling is, however, not uniform, so that occasionally parts of the bottom become overheated and the molten charge works its way down into the sand bed and floats some of this, or even some of the brick bottom up through the charge, or even worse, the charge may even run through the bottom entirely and fill up the vault, necessitating much trouble and expense for its removal.

To prevent these accidents, Herreshoff lays pipes through the furnace bed, running from one side of the furnace to the other and preferably not further apart than their own diameter. These pipes all end in two passages, one of which connects with a blower, the other passage delivers the air heated by traversing the pipes, into the pit below the firebox, thus not only cooling the furnace bottom, but also assisting combustion.

The bridge may or may not be cooled by additional transverse pipes or passages, which also terminate in the space below the firebox. Some of these transverse pipes may also be used for carrying tie-rods. In this case the tie-rod should be of sufficiently smaller diameter than the pipe, to permit an efficient circulation of air to keep the rod cool.

Below these transverse cooling pipes another set of pipes is run longitudinally, which are intended only for carrying the tie-rods and which consequently are not attached to any ventilating apparatus. However, with

these, too, the diameter of the pipe should be sufficiently larger than the tie-rod to permit a natural circulation of air through the pipe. The ends of these longitudinal pipes toward the grate are protected by plugs so as to prevent overheating this end of the tie-rod.

In a furnace protected in this manner any molten copper tending to run down through the bottom is cooled by the air passing through the pipe and simply cements the sand bed together, instead of tending to float portions of it up through the charge.

Goldfield Consolidated in January

The January production of the Goldfield Consolidated Mines Co. was 27,169 tons, containing $535,736, or an average of $19.72 per ton, of which 25,549 tons was milled with an average extraction of 93.76%, and 1620 tons was shipped, of an average value of $21.57 per ton, the net recovery from all ore being $18.57 per ton. The net realization was $327,956, or $12.07 per ton. The total cost of mining, development, transportation, milling, office and general expense was $6.64 per ton, distributed as shown in the accompanying table.

OPERATING COSTS AT GOLDFIELD CONSOLIDATED, JANUARY, 1913

Mining, including stoping and development	$3.09
Transportation	0.08
Milling	2.27
Marketing	0.07
General expense	0.30
Bullion tax	0.14
Construction	0.06
Marketing ore	0.70
Total cost of operation	$6.71
Miscellaneous earnings	0.07
Net cost per ton	$6.64

Development amounting to 3296 ft. was done during the month. Regarding the operations, Superintendent J. F. Thorn, in his monthly report, states: "The sill of the 136 BX stope on the second level of the Combination, about 350 ft. north of the shaft, was considerably extended, and produced 1375 tons of $30 ore. The 163-M stope is being cut about 50 ft. north of the 136-BX, and a drift between the two stopes indicates that they are of the same orebody, making a total length of nearly 200 ft., with an average width of 40 ft. Two raises in this ore have reached a height of 45 ft. Drifts, crosscuts and raises are being driven under this on the third level, but up to the present time not enough work has been done to demonstrate the downward extension of the ore.

In the Mohawk, the 466 crosscut in the foot wall of the 490-R stope, between the 450- and 600-ft. levels, and about 250 ft. south of the 354 stope, has been driven 20 ft. through $20 ore. Two raises and a crosscut under the big 354 sill are being driven in $50 ore. At the Laguna, rather an important discovery was made in the 348 intermediate, below the 329 stope, between the 450- and 600-ft. levels, 700 ft. north of the shaft. The 303-J raise, driven into the hanging wall of the 348, exposed 16 ft. of $80 ore. The 303-K raise, driven into the hanging wall from the 329 intermediate, 60 ft. higher up, exposed 12 ft. of $10 ore. Other raises are being driven to determine the extent of this ore.

The 604-W stope, on the downward extension of the 534 orebody, in the Clermont, just below the 900-ft. level, 750 ft. south of the shaft, produced 359 tons of $53 ore. The 802-A sill, on the 1300-ft. level, was considerably extended, and produced 862 tons of $25 ore, which was shipped to the smelter. The 420 stope, under the 413 sill, about 700 ft. south of the shaft, has been producing a large tonnage of good ore, which has brought the average grade of the Clermont up to about $40 per ton for the month. The formation on the 1400 is promising, and it is thought that the 1300 orebody will be found at this depth within a short time.

The diamond drill is on the ground, and should have been in operation about Mar. 1. A short hole will be drilled in the Reilly vein, on the 450-ft. level of the Combination, and after this hole is completed the machine will be used to explore below the 1400-ft. level of the Grizzly Bear. The estimated February production was: Total tons mined, 26,970; gross recovery, $513,000; operating expense, $165,000; and $348,000 net realization for month.

Leading Tin Producers in 1912

The following are the outputs of the leading tin mines abroad, dealt in on the London market (*Min. Journ.*, Feb. 22, 1913):

	Tons
Aramayo Francke Mines	3923
Tronoh Mines	2764
Tekka	591
Briseis Tin	535
Gopeng Consolidated	462
Lahat Mines	430
Pusing Bharu Tin Mines	391
Pengkalen	337
Redhills Tin Mining Co.	334
Siamese Tin Syndicate	302
Kinta Tin Mines	199
Pusing Lama	150
Kramat Pulai	116
Tingha Consolidated	115
Siputeh Tin Mines	106
Rambutan	98
Kledang Tin Mining Co.	77
Mt. Brown Tin Mining	51
Taiping (Hydr.) Tin	12

Improving Conductivity of Electrical Joints

It is obvious that considerable loss may occur through imperfect metal-to-metal contact on switchboards, especially where the copper is bolted together and the pressure is not very great.

A test made recently at the Laboratoire d'Electricite, on joints made in accordance with the best French practice, says *Power*, Feb. 25, 1913, showed that on a busbar carrying 1760 amp., 84.5 watts were lost per hour due to heating. In a plant operating 10 hr. per day and 300 days per year, this would represent 253 kilowatt-hours per year. While this may not appear large, it should be remembered that this was only one of a number of similar joints on the switchboard.

A preparation has recently been put on the market which is claimed to reduce this loss by about 85%. It is called "Optimus Plastic Alloy," and is in the form of a metal putty, which is a good conductor and fills up all the cavities in the surface. It is claimed the plates are thus made continuous electrically, and also that moisture is prevented from entering. The alloy is put in cold and does not prevent the copper from being separated readily when desired.

Coal Fields for Katanga—The semi-official "Journal du Congo" confirms the discovery of large coalfields near Katanga, on the western shore of Lake Tanganyika ("Min. Journ.," Feb. 22, 1913). The latest information states that from seven to eight coal measures averaging up to two meters width have been proved; they extend over an area of 100,000 hectares.

NEW PUBLICATIONS

EMERY AND THE EMERY INDUSTRY. By A. Haenig. 5x7½; pp. 103; illus.; $2.50. D. Van Nostrand Co., New York.

LA STIMA DELLE MINIERE. By Nunzio Ziino. 7x9¾; pp. 140; paper. Scuola Tip. Boccone del Povero, Palermo, Italy.

ENGINEERING AND METALLURGICAL BOOKS, 1907-1911. By R. A. Peddie. 5x7½; pp. 206; $1.50. D. Van Nostrand Co., New York.

DIE CHEMISCHEN VORGANGE BEI DER CYANLAUGUNG VON SILBERERZEN. By Emil Kühn. 6¾x9¾; pp. 108; illus.; paper; 6 marks. Wilhelm Knapp, Halle a. S., Germany.

MINES OF AFRICA, 1913. By R. R. Mabson. 5¼x7½, pp. 819, illus.; 21s. The Statist, London, Eng.

This directory or handbook contains a complete alphabetical list of all African mining companies, giving in concise form, information obtained chiefly from company reports and official data. A series of maps of the Rand and other districts, and one of South Africa are included.

SOUTH AFRICAN MINING DIRECTORY AND MONTHLY HANDBOOK OF CHIEF OFFICIALS OF THE MINES. 5½x8, pp. 208, paper; subscription price, South Africa, £2 2s.; other countries, £2 10s. South African Mining Directory, Ltd., Johannesburg.

This is a monthly handbook devoted rather to commercial than financial interests. Lists of the mines in southern Africa are given, with the principal officials thereof. Division is made geographically and according to the metal produced. A list of small mining concerns is included, beside railways, organizations and industrial enterprises concerned with mining. A list of materials consumed and a buyer's guide, together with alphabetical lists of mine officials indicate the purpose and nature of the work.

MINING ENGINEERS' EXAMINATION AND REPORT BOOK. By Charles Janin. 5¼x7¾, pp. 94, Illus., Leather; $2.50. Part II may be purchased separately at 50c. Mining and Scientific Press, San Francisco, Calif.

This is published in two volumes: Part I containing suggestions as to the information that should be included in a mine report, useful tables, legal forms, examples of cost-estimate sheets, etc.; Part II being a small skeleton report form, bound in pressboards, inserted in a cover pocket in the main volume; it is also sold separately. While there is little in the book that will be new to examining engineers, there is much useful information that has been gathered into convenient form. As stated in the preface, this little volume was written to guide prospectors, owners, promoters and others in presenting a concise and comprehensive report on mining property, and as such should serve its purpose well.

DIE ANALYSE DER SELTENEN ERDEN UND DER ERDSAEUREN. By R. J. Meyer and O. Hauser. (Vols. XIV-XV of Die chemische Analyse). 6½x10, pp. 320, Illus.; 10 Marks, Ferdinand Enke, Stuttgart.

The authors have felt, in view of the ever-increasing interest, both scientific and technical, in the rare earths, that some authoritative manual was needed for their determination. In this they have attempted to give only tested methods, and to avoid the repetition of classical errors, simply because they were classical methods. The book is divided into two main parts: Qualitative and quantitative. A discussion of the general characteristics of the earths is given first, then the specific reactions of each element, and a chapter on the general examination of a mixture of earths. Those covered are: Group (a), Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sc, Sm, Tb, Tu, Y, Yb; group (b), Th, Ti, Zr; group (c), Nb, and Ta. There are many spectrum plates given for guidance in making spectrum analyses, a special chapter being added on this subject, in addition to the spectroscopic notes on each element in the section devoted to its determination. A chapter also treats of the special analytical methods used in the thorium-compound and gas-mantle industries. Any chemist working in this special line should have this book.

EXPLOSIVES: A SYNOPTIC AND CRITICAL TREATMENT OF THE LITERATURE OF THE SUBJECT AS GATHERED FROM VARIOUS SOURCES. By H. Brunswig. Translated and Annotated by Charles E. Munroe and Alton L. Kibler. 5½x8¼, pp. 350. John Wiley & Sons, New York.

To the mine operator in search of practical help in solving his problems of breaking rock, Doctor Brunswig may not at first glance seem to offer aid, but short cuts to knowledge are usually hard trails to travel and any effective study of blasting cannot afford to neglect the essential and fundamental principles involved. It is these principles that are here discussed by the author, who modestly disclaims originality of material, but makes his plea for a new method of treatment hereafter in attacking the subject of explosives, namely, the chemical-physical method applied in a mathematical and quantitative way, together with the abandonment of empiricism; and to further this purpose he offers this summary of past experiments and existing theories. The result is such as could hardly have been improved upon.

The nature of an explosion is first discussed and the vexed question of a proper definition; and three conditions are given which an explosive substance must satisfy, namely, the liberation of heat, extreme sensitiveness and susceptibility to shock or initial impulse. The velocity of explosive reactions, the pressure generated, the temperature, explosions by influence, and the flame after explosion, are then treated at some length.

To many readers, Part II of the book may prove most interesting. Whereas, in discussing general theories, the author refers to various gases and substances common only in the laboratory, he confines himself in Part II to those solid and liquid substances actually used in practice, and discusses their nature and characteristics in a way as interesting as authoritative. The blasting explosives, such as nitroglycerin, dynamite, and black powder, receive a large share of his attention and despite the theoretical nature of the work, an abundance of practical hints are given. Table 55, a list of common explosives with their nature, their composition and the designations of their varieties in various countries, is of a nature to prove most valuable.

The German origin of the book need deter no American reader, as the translators have done their work excellently and the author has drawn his information impartially from all countries. The complete subject index is well supplemented with a list of references and an index of authors. In his preface, Doctor Brunswig warns his readers that his technical position prevents his criticizing, in the light of inside information, some of the material presented. To refrain, for commercial reasons, from comment on information known to be incorrect is common enough practice, but to honestly confess the fact, is both unique and refreshing.

GEOLOGY OF THE UNITED STATES OF NORTH AMERICA. By Eliot Blackwelder. Part II, Volume VIII, of "The Handbuch der Regionalen Geologie." 7x10½; pp. 258; figs. 81; paper; 11 marks. Carl Winter, Heidelberg.

The cosmopolitan nature of geology is well illustrated in the "Handbook of Regional Geology" now being issued under the editorial oversight of Professor Steinmann, in Bonn, and Professor Wilckens, in Jena. Ten parts have already appeared in addition to the subject of this notice, viz.: Denmark; Iceland; the Philippine Islands; the Middle-Atlantic volcanic islands; New Zealand; Madagascar; Spain; Persia; Oceania, and Armenia. The titles will show at a glance that the books make easily accessible descriptive matter, which would otherwise be out of reach or so scattered as to be not readily attainable. The books are especially serviceable to a traveler of scientific education, who desires to go about in an intelligent manner in the country described. The works are variously issued in French, German or English. The volume on the United States is in the modified spelling form of English.

Professor Blackwelder reviews at the outset the physiography, under six topographic divisions, viz.: The Eastern Highlands; Coastal Plains, Interior Plains; Western Mountains and Plateaus; Rocky Mountains; Intermountain Plateaus and Ranges; and Pacific Ranges. We miss in this list the Appalachian province; the Great Lakes, and the Great Basin, all names so familiar that it may be questioned if the new ones quite fill their places. Subsequently, in discussing the structural geology they do appear to a certain extent under Orographic Elements, but a reader familiar with this country parts unwillingly with them.

Following the physiographic outline the stratigraphic column is taken up by systems and series. Under each the characteristics in the more important regions are summarized. The systems and their subdivisions having been established, an outline of geologic history logically follows. Period by period it is concisely traced.

The largest of the individual parts of the book is given to a discussion of structural geology under the head of Orographic Elements. Fifteen of these are passed in review, and for the more important, tabular statements of the stratigraphy in special localities have been prepared. They greatly help a reader amid the bewildering array of formational names now such a feature of American geology. An important chapter on the economic geology follows with separate treatment of the more prominent mineral products. A condensed bibliography concludes the work. The book gives a very useful summary in such form as to aid a traveler and give a student a bird's-eye view of the geology of the United States.

J. F. KEMP.

CORRESPONDENCE AND DISCUSSION

Lake Superior Iron Ore Leases

Absence from home has delayed my copies of the JOURNAL, and I have just received the issue of Feb. 8, 1912, in which appears the animadversion of Carl Zapfe upon some statements of mine, which were published earlier.

Mr. Zapfe objects to my statement that the Northern Pacific road had paid 70c. royalty for a Cuyuna lease. I had what I considered unquestionable authority, but must defer to Mr. Zapfe's superior and intimate knowledge. Evidently it is with him, in this matter, a case of *"quorum magna pars fui."*

As to mining on lands of the Northern Pacific; it has long been generally supposed that this company was a common carrier, and that it might haul fruit without owning orchards. The control of orchards by railway companies may be, perhaps, a result of transportation rather than a cause. But as to iron ore; the assemblage of Cuyuna lands leads to the impression that this company may have in mind some such mining and transportation deal as Mr. Hill put over on the Mesabi Range in 1907, and time alone will convince the general mining fraternity of the falsity of this impression.

DWIGHT E. WOODBRIDGE.

Cananea, Sonora, Mex., Feb. 19, 1913.

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Title Difficulty at Rochester

If the boosters for the new Nevada discovery called "Rochester," in Humboldt County, Nevada, are giving the JOURNAL news items on the camp, do not overlook the fact, as they do, that this place, easterly from Oreana, a station on the Southern Pacific R.R., is within the Congressional land grant by the Government years ago, to the Central Pacific railroad.

Mining companies offering stock for sale in this place are unable to get title to the ground, and the public is being misled accordingly.

H. WISENER HAMMOND.

Boise, Idaho, Mar. 1, 1913.

[Regarding minerals upon land granted to railroad companies, the following statement is found in "A Manual of American Mining Law," by A. H. Ricketts, p. 48, section 29:

(1) RAILROAD LANDS—Land grants to certain transcontinental railroads have from time to time been made by Congress upon substantially similar terms and conditions as to certain of the states as to the character of the land within the limits of the grant; coal and iron deposits therein, however, being excluded from the operation of the mining laws.

(2) CLASSIFICATION OF LAND—There is no provision in any of these grants for the demarcation of mineral lands therein except that the land within the grant to the N. P. R. Co. within the states of Montana and Idaho is subject to examination and classification by a commission appointed under an act of Congress.

(3) INCONCLUSIVENESS OF CLASSIFICATION—The return of this commission as to the character of the land is not conclusive.

(4) SUBSEQUENT DISCOVERY OF MINERAL—After title has passed to a railroad company no mineral rights in the land covered thereby can be initiated thereon without its consent.

(5) REJECTION OF APPLICATION FOR PATENT. Where it appears that an application for a mineral patent embraces land within a railroad grant the application will be rejected by the local land officers. The applicant may appeal from the order of rejection and apply for a hearing to determine the character of the land.

(6) LAND DEPARTMENT—Land-grant-aided railroads usually maintain land departments in order to facilitate the disposal of such lands. Such departments are, of course, unconnected with the United States land department.

This seems to indicate that the status of the land in question depends largely upon whether or not it has been patented by the railroad, assuming that it is within the limits of the Congressional grant. Communication with the offices of the Southern Pacific Co. in this city failed to secure a definite statement on the matter.—EDITOR.]

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Precipitation Temperatures

My attention has been called recently to the effect of temperature of pregnant cyanide solutions upon the success or degree of precipitation. While the effect of temperature of solutions upon their dissolving properties has been thoroughly investigated and recorded, I have been unable to find anything satisfactory concerning temperature in its effect upon precipitation and I trust that this subject is of sufficient merit to find a place under your department of correspondence and discussion.

Of the two specific cases that have come to my notice, one was in a plant precipitating a low-grade gold-bearing solution by means of zinc dust, using the Merrill press, and the other in a plant precipitating a fairly high-grade silver-bearing solution by the zinc-shaving method. In both cases it was found that not only was the extent of precipitation lessened, but in some instances the tail, or so called barren sample, was higher in value than the head or pregnant sample, indicating redissolution of precipitate. These conditions were noticed when the solution to be precipitated fell below 50° F. in temperature.

In plants where the solution is kept at summer warmth at all times in order to benefit its dissolving action, the matter will be of little importance for the reason that all solution in the mill will have a temperature higher than 50° F., but in plants where no such attempt is made it becomes of considerable interest in that the "barren" solution must be again precipitated with a resultant increase in zinc consumption for a zinc-dust plant and a loss of time and labor for either a zinc-dust plant or a zinc-shaving plant.

The reason for the decrease in amount of precipitation would seem to be that the chemical reactions which take place are retarded by low temperature, but this will not explain why some of the precipitate is picked up by the solution during its contact with the zinc and precipitate unless the electro-motive order of the elements in cyanide solution is disturbed by change of temperature. An interesting question in this connection is, "Under what conditions can all of the precipitate be redissolved by

cyanide solution?" It has been suggested here that even if no zinc were added to that already with the precipitate, the sulphides present in the precipitate would immediately throw down what precipitate might be dissolved.

EDWARD H. SMITH.

Blair, Nev., Mar. 4, 1913.

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Food Supplies for Miners

I inclose a detailed table of the food consumed in the boarding house of a Nevada mine during six months, from July to December, 1892. While prices may have risen, the quantities and classes of food will not have changed materially. The boarders were nearly all miners of middle age, there being neither old men nor boys in the force. All told, there was provided 10,002 days' board, 9287 being for the boarders and 715 for the Chinese servants. Accounts were carefully kept, the weights in most part being taken from the bills of the purveyors. All fresh meats were reweighed. The weights of canned fruit and vegetables were obtained from the packing houses.

CONSUMPTION OF FOOD AT A NEVADA MINE

	Quantity	Weight Pounds	Cost
Farinaceous			
Corn meal		210	$10.81
Corn starch		54	6.01
Cracked wheat		50	2.79
Flour		7,800	280.41
Flour, buckwheat		60	3.93
Flour, graham		88	5.51
Oatmeal		370	23.91
Pearl barley		10	.68
Rolled oats		215	10.84
Rice		478	36.67
Sago		70	5.40
Tapioca		20	1.64
Macaroni		88	8.75
Fish			
Codfish		219	20.87
Mackerel	2 ½-bbl.	160	27.95
Salmon	2 ¼-bbl.	225	24.07
Salmon bellies	1 ½-bbl.	45	5.00
Clams	98 cans	46	21.30
Oysters	99 cans	74	27.93
Salmon	159 cans	209	37.79
Fruit, Canned, for Pies			
Apples	58 cans	290	29.73
Apricots	37 gal.	185	19.59
Blackberries	35 gal.	175	21.27
Currants	2 gal.	10	1.33
Gooseberries	21 gal.	105	12.61
Grapes	15 gal.	75	9.30
Peaches	16 gal.	80	8.87
Plums	17 gal.	85	8.90
Fruit, Canned, Table			
Apricots	14 gal.	70	9.54
Cherries	24 gal.	120	19.90
Grapes	9 gal.	45	6.75
Peaches	36 gal.	180	28.67
Pears	8 gal.	40	6.70
Plums	12 gal.	60	7.90
Fruit, Dried			
Apples		169	20.55
Apricots		20	3.10
Dates		59	4.90
Figs		91	7.64
Peaches		24	2.48
Pears		15	1.50
Prunes		83	9.99
Raisins		268	24.92
Fruit, Fresh			
Apricots, berries, cherries, grapes, melons, peaches, pears, plums		2,204	103.80
Apples		872	54.68
Oranges		60	5.12
Tomatoes		435	13.25
Canned Vegetables			
Beans	31 gal.	131	17.39
Corn	91 cans	113	15.98
Peas	26 cans	124	16.07
Tomatoes	77 cans	500	36.84
Meat, Fresh			
Beef (quarters)		17,391	841.95
Mutton		1,757	149.38
Pork (720 lbs. from own hogs)		776	4.76
Meat, Salt			
Bacon		511	75.30
Ham		852	135.28
Pig's feet		155	14.64
Sausage		165	14.24
Tripe		160	12.64
Miscellaneous			
Baking powder		85	34.77
Beans		447	20.95
Brandy	3 gal.		10.52
Brooms	16		5.59
Butter		1,749	423.74
Candles		42	5.23
Candy		13	1.61
Cheese		107	14.01
Chow-Chow		20	2.92
Citron		10	2.64
Coal oil	40 gal.		16.25
Coffee		183	41.87
Crackers		642	53.40
Cranberries		100	14.44
Crockery			27.43
Eggs	7260	1,000	225.01
Extracts	396 oz.		16.54
Honey		60	3.90
Hops		4	3.30
Horse radish		40	5.13
Ice		653	16.64
Jelly		88	11.46
Lard		181	21.56
Lye		114	11.41
Milk, fresh	722 gal.		304.40
Milk, condensed	185 cans		32.58
Nuts		18	3.22
Peas, split		23	1.77
Pickles	3 gal.		3.98
Salt		665	12.76
Saltpeter		44	6.60
Saleratus		12	1.18
Sauce—Worcestershire	6.5 gal.		5.76
Soap		203	19.25
Ginger		7	1.67
Mustard		5	1.44
Nutmeg		1	.65
Pepper, black		28	5.13
Pepper, red		1	.24
Sugar, granulated		4,074	343.82
Syrup	10.5 gal.		5.87
Tea		144	58.90
Turkeys, dressed		247	52.43
Cabbages, beets, turnips, onions, parsnips, squash, lettuce, radishes, green onions, and other vegetables		8,324	231.88
Potatoes		14,051	297.72
Vinegar	49 gal.		21.74
Wood	22.5 cords		242.00
Totals		71,309	$4,994.49

The total food consumption was over seven pounds per man per day, costing about $0.50. The principal items were ¾ of one egg, or 0.10 lb. per man per day; butter, 0.17 lb.; flour, 0.79 lb.; preserved fish, 0.10 lb.; canned fruit, 0.15 lb.; fresh fruit, 0.3616; fresh meat, 1.99 lb.; salt meat, 0.18 lb.; sugar, 0.41 lb.; vegetables, 0.83 lb.; and potatoes, 1.41 lb. Potatoes and fresh meat thus formed almost one-half of the total by weight.

WILLIAM HILLMAN.

London, Feb. 22, 1913.

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The Butte Geological Report

The director of the U. S. Geological Survey has kindly noted an error in my letter concerning the publication of the Butte report, and I am glad to take two years from his shoulders. As a detailed account of the various steps between the informal submission of the report in 1907 and its formal transmission in 1909 is of no general interest, it will not be given, but I desire to express my hearty accord with Doctor Smith's views and my full appreciation of his splendid administration of the great organization of which he is the head, and which is itself the greatest of its kind in the entire world.

WALTER HARVEY WEED.

El Paso, Tex., Feb. 17, 1913.

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The Antimony Industry of China

In my article, "The Antimony Industry of China," in the JOURNAL of Oct. 26, 1912, p. 777, on the map and in the reading matter, "Suishan" should be changed to Fan Ching Shan. Suishan should be in the southeast corner of Szechuen, close to the Yunnan and Kweichow boundaries.

C. Y. WANG.

Canton, China, Jan. 10, 1913.

EDITORIALS

Respecting Some Hairsplitting

The Director of the U. S. Geological Survey recently issued a circular letter with respect to the statistical work of the Survey in which it was remarked that "one of the leading mining journals . . . . . printed as of its own compilation the table of gold-silver production issued jointly by the Bureau of the Mint and the Geological Survey, but only slightly changed. In other columns of this issue the credit given to the Survey data was incomplete and in most cases entirely lacking, although the data was generally used with very slight modifications." This letter came to our attention, but it did not occur to us that the Director of the Survey referred to us. Not so with our contemporary in San Francisco.

We had to ask the Director of the Survey if he meant us, or not. After sending him one letter and a telegram we were informed by him that our letter was being given careful consideration, but that a full reply was "being delayed somewhat." A second telegram to him requesting an answer of "yes" or "no" elicited the telegraphic message, "Full reply later. Believe can satisfy you your journal at fault." We had to await the Director's full reply. Hence our delay.

It is well known by everybody, including the Director of the U. S. Geological Survey and his staff, that the main portion of the statistical work published in the New Year number of the JOURNAL is based upon our own investigations, conducted by mail and telegraph, which is not done by any other mining paper. It is also well known to the Geological Survey, which has imitated our methods in collecting statistics, that the JOURNAL uses largely of the telegraph, whereas it uses only the mail.

It is well known by everybody, including the Director of the U. S. Geological Survey, that there is no paper more punctilious than the JOURNAL in making acknowlments to other publications. Readers will find in every issue of the JOURNAL ample evidence of its consistent policy to give credit where credit is due; all members of the JOURNAL staff have standing instructions to that effect.

The JOURNAL has not, for a matter of 15 years or so, attempted to collect the statistics of the production of gold and silver in the United States, but has adopted the statistics compiled by the Director of the Mint, which have been admirable for their promptness and praiseworthy for their accuracy. The statistics for 1912 were communicated to us by the Director of the Mint, as previously, and in our publication of them were credited to him, as previously. There was manifestly no attempt on our part to represent them as our own. The Director of the Survey now admits this, but does not like our manner. This, however, is a very different thing from his previous bald charge of "printed as of its own compilation," etc. Also, the Director admits that other pieces of information derived from the Survey were duly credited.

He brings to our attention, however, certain things that had escaped our recollection. A brief article on Arizona, and under the captions of "New Mexico" and "Nevada" a few paragraphs introductory to the articles of our own contributors were composed in this office from various data available, including a report published by the Survey and including a very absurd error of the Survey, which ought to have been apparent to us; and no mention of the Survey was made, the responsible writer explaining that he understood that a general acknowledgment was to be made on our introductory page. None of this matter embodied any special research or was of any particular consequence anyway. But we are not making excuses to evade an apology, which we here tender to the Survey. Nor is our mortification, especially over our repeating of a foolish mistake, tempered by our knowledge that the Survey itself, in its annual book on the mineral resources, has year after year copied statistics of the JOURNAL without any recognition whatsoever. We may suggest that people who live in glass houses, etc.

And lest our "virtuous" contemporary in San Francisco become too exalted in its self-esteem, let it look in its mirror and compare its uncredited article appearing on p. 315 of the same issue in which it made some remarks about us with an article that appeared in an official Australian journal of several months previous, and especially observe the engraving, in which the imperfections of the original are faithfully reproduced. The idea about people living in glass houses again occurs to us.

Common-sense respecting this incident is the recognition that there is no proprietorship in news. We fancy that the U. S. Geological Survey makes liberal use of the JOURNAL just as we do of its publications, and that neither makes all possible acknowledgments, nor is that necessary, nor ought it to be claimed. It is easy in the leisure following the publication of our great New Year number to see many places where explanatory footnotes, indicating figures estimated, authorities, etc., which ought to have been given, were omitted by oversight or inadvertence in the hurly-burly of the last few days, which is inevitable in the making of such a publication. The really remarkable thing is that there are so few of such oversights.

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A Contemporary with an Ax to Grind

The *Mining & Scientific Press* has so well schooled itself in miscellaneous abusiveness and as an exponent of falsifying innuendo that it is time its readers should be rightly informed about it. We believe we are not far out of the way in our assumption that substantially all of its readers are our readers. We have heretofore ignored its numerous carping references to us, we being engaged in minding our own business; nor does this kind of journalism comport with our ideas or our liking.

In a recent issue the *Press* took up a circular of the Geological Survey covertly charging a leading mining

paper with copying statistics without credit, and interpreted that as the JOURNAL. Therefrom it proceeded by curious convolutions of mental process to argue that this illustrated "that technical papers should be owned and controlled by technical men." Further, that "if an engineering paper is to represent engineers and be more than a lure for advertisers, it must be conducted along lines that engineers recognize as ethical." We have observed that the ethical ideas of the *Press* permit it to send out editorial writers in company with its advertising solicitors, which is a lure for advertisers that we have not yet learned how to practice.

The JOURNAL does not have to do any explaining about its editorial policies, its ethics or its ownership. We are under the impression that our ownership consists mostly of technical men, though they do not all possess university degrees.

In attempting to depreciate the JOURNAL and magnify itself, the *Press* is both insulting and pretentious. The editor of a great paper stands for his opinions; the owners of such a paper would not have him do otherwise; if the editor's expressions of opinion were interfered with, he would resign. The *Press* knows this, inasmuch as its controller was once editor of the JOURNAL and had *carte blanche* just as the present editor has; and knowing this, the *Press* is not only hypocritical, but also slights the intelligence of its readers in trying to palm off on them what it knows to be false innuendo. Is there anything more despicable?

What its readers do not know, however, is that the *Press,* a pseudo-palladium of professional ethics, journalistic ethics, etc., does not find that the same principles need to be applied in its own business matters. Nor has the professed idea of this British-controlled paper that "technical papers should be owned and controlled by technical men," which it says we are not, restrained it from making overtures to us to buy it out.

The persons who are always talking about their own ethics, honesty, propriety, etc., are just the ones to look out for. It is about the same with newspapers as with persons.

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Improvements at Lluvia De Oro Mill

In the description of the practice at the Lluvia de Oro mill elsewhere in this issue, H. R. Conklin presents some details which should prove of interest to cyaniders generally. Mr. Conklin's problem was not to design a new mill, but the more difficult one to make an efficient plant by rearranging and adapting equipment already installed.

The statement that slow-speed chilean mills proved unsatisfactory as grinders following the stamps, owing to the extreme hardness of the ore, may cause surprise to some, unless all conditions are considered. In the first place, for maximum extraction it was necessary to slime the ore and since the Nissen stamps were performing the work of crushing satisfactorily, the crux came in furnishing a machine to follow them, the product of which would be essentially slime. For this purpose, the chilean mill manifestly would be miscast and the change to tube mills seems a logical one.

The present practice at Lluvia de Oro includes a continuous system of cyanidation which is unique in several respects. In most mills using continuous cyanidation, the approved system is to have ore and solution pass in opposite directions. Thus the barren solution is added to the last tank, from which it overflows to the next preceding tank and so on up the series, until it is drawn off at the head tank as pregnant solution for precipitation. This is good metallurgical procedure and Mr. Conklin has made use of the principles upon which it is founded in working out the system at Lluvia de Oro.

It will be observed that at this mill, barren solution is added to the pulp at each of the three middle thickeners and water at the last thickener. The overflow solution from the first thickener only is precipitated, the solution from the other thickeners making up the circulating mill solution. This system requires a somewhat larger solution-storage capacity than the countercurrent system, but the gain in extraction due to frequent changes of contact solution would undoubtedly more than counterbalance this item. The comparative results of the intermittent and continuous systems show that, at this mill at least, the continuous system is far superior.

A unique feature is the method of transferring the pulp from one thickener to the next by means of barren solution and ejectors. Other cyanide operators may find in this a valuable suggestion. The possibility of obtaining intimate contact between barren solution and ore alone makes it worthy of consideration.

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Mining in Mexico

In spite of the rule of blood and iron affairs in Mexico fail to become settled and the mining industry there is still hampered. Whereas a few weeks ago Diaz and Huerta were rebelling against poor Madero, now other leaders are rebelling against Diaz and Huerta. The State of Sonora is in arms and secession is talked about, which is the first talk of that sort in Mexico. There has been fighting at El Tigre, Nacozari and Cananea; and the Federals have been driven out of El Tigre and Nacozari. Whichever side wins, however, the great American interests are let alone. This has been a striking feature during the two years of war in Mexico. It has been surmised that the rebels of all stripes are under some powerful restraining influence. However that may be, it is certain that they have generally recognized that they must maintain an influx of money into the country and consequently must let the big mines be kept in operation. There has been considerable marauding, but on the whole, it is surprising how little the big mining companies have suffered. Not a day has been lost at either Nacozari or Cananea. The worst feature in that region, as well as in others, has been the destruction of railway bridges, track, etc., and the consequent interruption of communication. However, scarcely anybody has been doing any new construction in Mexico, and, of course, nobody is thinking very hopefully of new enterprises, although we have heard of some optimists planning promotions.

❋

Dr. James Douglas has reported to the subscribers to the land fund of the American Institute of Mining Engineers that the subscriptions now amount to $60,350 and continue to come in. He thinks that the full amount needed will be provided by the members. However, the deficit, if there be any, has been guaranteed by himself and some other persons. The liquidation of the mortgage now being assured, subscribers are requested to remit the amounts which they promised to pay.

BY THE WAY

One of the small Nevada gold mines has adopted a new method of ore transportation, says the Boston *News Bureau*. Recently the company shipped 20 sacks, weighing a total of 210 lb., by parcels post to a testing company in San Francisco.

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In a recent case in London, counsel examining the plaintiff, C. H. Stevens, made the following remarks, according to the *South African Mining Review*, regarding miners' phtisis: "This disease is, as I understand it, that when miners have to work for gold their lungs become filled with gold dust, and they contract lung and chest troubles from which they eventually waste and die."

❋

The myriawatt is a new unit proposed by Messrs. Stott and O'Neill to take the place of a boiler horsepower. It is recommended for adoption by the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. The unit would have a value 10 times as great as a kilowatt, as its name signifies. It is equivalent to 34,150 B.t.u. per hr., being thus about 2% greater than the old unit of a boiler horsepower and 13 or 14 times as great as a horsepower.

❋

The "dowsers" are to have an inning in France, if a Paris dispatch to the *Times* is to be credited. It reports that the Academy of Sciences has appointed a special commission to inquire into the properties of the divining rod. It is intended to make "an exhaustive study of the claims of those who profess to be able to discover underground springs by this means with a view to ascertaining whether the powers claimed by 'dowsers' are authentic, and if so, what scientific principles are involved." We suggest that some important testimony could be given the Academy by the Stauffers of Palmyra, Penn., former manufacturers of Spanish needles, goldometers and other "gold-finding" devices.

❋

The report of the Copper Producers' Association for February caused general surprise, especially because of a decrease in the surplus instead of an increase. If the statistics had shown an increase of 10,000,000 lb. it would have been about what was generally expected. The refiners' statistics of recent months seem to show that lately we have been experiencing a shifting of stocks, or perhaps we should say an extraordinary drain on the invisible stocks, rather than any noteworthy relaxation in the rate of consumption. The production of American refiners in February continued large and the failure of the reduced mine production to exhibit itself is now becoming as much of a mystery in the trade as the opposite condition was just a year ago.

❋

The lowly spider must now be added to our list of domestic animals. We are informed by the *Canal Record* of Feb. 19, that in the Gorgona shops a number of spiders are carefully protected in the instrument room. The object of this especial care is to obtain suitable web for surveying-instrument crosshairs. The instruments were originally fitted with platinum wires, but a lack of that material has led to the necessity of utilizing the spider web. Unfortunately, spider web in damp weather, or early in the morning, is not taut, and not until the instrument warms up is it satisfactory. An order has been placed for more platinum thread, and upon its arrival a half-dozen industrious spiders will be out of a job. Here is a chance to Burbankize the spider so as to produce spider webs having the same coefficient of expansion for heat and moisture as the metal in a telescope tube.

❋

It has been demonstrated, writes John Power Hutchins, that various grains can be grown and cattle raised along the Siberian railway, even where there is perpetually frozen ground at a depth of a few feet in midsummer. About $25,000,000 worth of butter is sent yearly from the steppes of West Siberia, where wonderfully rich soil, like that of the American prairies, is found, but with cold winters, though no colder than those of northern Canada. The world does not need nor demand that Siberia be intensively cultivated at present, but it will, in the future, and then there will be a marvellous development. Are the Alaskans not, perhaps, erring in not attempting to raise wheat and meat at home in Alaska, instead of importing it, and thus lower the cost of mining? The shiftless Russian peasant is doing it, where there is perpetually frozen ground, in Siberia. Why then should it not be similarly possible in interior Alaska, where there is an almost identical climate?

❋

The sensitiveness of buyers of certain ores for which there is a limited market is well illustrated in the experience related by President F. W. Frerichs in the *Proceedings* of the American Institute of Chemical Engineers. While a manufacturer of medicinal preparations, Mr. Frerichs was looking for an independent supply of bismuth and had gone to Colorado where he had been told that argentiferous and auriferous bismuth ores had been found. It was known that several lots had been mined, but every one was reluctant to give information regarding same. The American smelters were paying only for the gold and silver and charging a penalty for the bismuth because the latter deteriorated the lead with which the gold and silver was collected. Through an assayer in Leadville, Mr. Frerichs learned that the parcels of ore above mentioned had been sold to a firm in England, having been shipped by way of Galveston. It seemed to be a condition of the sale that it should be kept a secret and the sellers were not to sell subsequent lots to anybody else. If they should sell to any other party, contrary to the understanding, the buyers threatened not to buy any more from them. "This being the case," says Mr. Frerich, "I could not secure any large lots of ore but nevertheless obtained a sample of several hundred pounds with which to make experiments. Meantime a new mine had developed some similar ore and offered to sell the entire output for a period of four years to my company. The mining company would not sell smaller lots from time to time, for fear that the English buyers would boycott it, in which case it would not have an outlet for its ore. In order to obtain the ore it was necessary to negotiate a contract to take the entire output for four years, which was estimated to contain 160,000 lb. of bismuth. The bismuth was paid for at the rate of $1 per lb. which, including the gold and silver, was equivalent to a total of $288,000 for the entire contract."

The Reply of Doctor Struthers

The following self-explanatory communications, relating to direct and implied criticisms prior to the A. I. M. E. elections, have been received from Dr. Joseph Struthers, with request to publish:

To the Editor,

ENGINEERING AND MINING JOURNAL:

Inclosed please find a copy of a letter to me from Charles F. Rand, president of the American Institute of Mining Engineers, which is a conclusive reply to the direct and inferred criticisms, so far as they refer to me, appearing in the editorial notice in your issue of Feb. 8, 1913. I respectfully request, as a matter of justice, that you will publish this present communication and the letter from Mr. Rand in an early issue of your paper.

JOSEPH STRUTHERS.

New York, Mar. 5, 1913.

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To Dr. Joseph Struthers,

New York:

Your letters of Feb. 21 and 24 have been received, together with copies of the *Metallurgical and Chemical Engineering* of September, 1912, the *Mining and Scientific Press* of Jan. 25 and Feb. 8, 1913, and the ENGINEERING AND MINING JOURNAL of Feb. 8, 1913, in which latter the suggestion is made that you demand an investigation; with the request on your part that the criticisms appearing in these publications as far as they relate to you should be considered by the board of directors or the executive committee of the Institute.

Your letters and the accompanying newspapers have been carefully considered by the executive committee. We are very glad to state that no charges of any kind against you are in existence before the board.

Your accounts, as assistant treasurer, have been audited annually by a firm of certified public accountants and always found correct.

As to the excursions which are specifically referred to by the *Mining and Scientific Press,* you are entitled to the statement which we very gladly make that you did not originate the system by which such excursions were conducted. The system had prevailed for many years, and before you became connected with the administrative work of the Institute.

With regard to the reference in the *Mining and Scientific Press* to the New Haven and Spokane meetings, we now find that there was no Institute excursion connected with the New Haven meeting, and understand that you had no financial relation beyond the receipt of salary and expenses to the excursion connected with the Spokane meeting. Both of these meetings were held while you were assistant secretary and before you became secretary of the Institute.

A committee of the board and council has already inquired into the conduct of the excursion to Japan, which was under your charge, and exonerated you, as shown in a report which has already been published.

As to the letter of Messrs. Corning and Stone, published in *Metallurgical and Chemical Engineering,* last September, we appreciate the position taken by Doctor Raymond and you at the urgency of your friends, to abstain from any newspaper controversy which might have been harmful to the Institute. At the same time we are pleased to say, concerning the general charge which might be construed to include you, that you have not received an excessive salary and that you have not been inefficient in the office work.

The executive committee consists of Charles F. Rand, Benjamin B. Thayer, A. R. Ledoux, Joseph W. Richards and James F. Kemp.

CHARLES F. RAND, President,
American Institute of Mining Engineers.

New York, Mar. 5, 1913.

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Homestake Mining Co.

BY JESSE SIMMONS

A prosperous year was experienced by the Homestake Mining Co., operating the Homestake gold mine, at Lead, S. D., according to the annual report for 1912. During the year 244 bars of bullion, of a gross value of $6,600,953, was recovered from 1,528,923 tons of ore milled; an average realization of $4.3174 per ton. The cash on hand, Jan. 1, 1913, was $1,455,958, nearly $1,000,000 more than the balance a year ago. During the year dividends amounting to $1,310,400 were paid. Among the miscellaneous receipts for the year were: Blacksmith shop, $5258; discount and interest, $21,485; foundry, $97,312; machine shop, $1908; timber, $55,327. Including the cash balance, the total receipts were $7,289,367 for the year. The expenses are shown in an accompanying table; the per ton costs I have calculated.

HOMESTAKE OPERATING COSTS FOR 1912

	Total	Per Ton
Mining	$2,531,315	$1.656
Milling	896,107	0.586
Sundry	734,981	0.480
General and taxes	360,606	0.236
Gross operating	$4,523,009	$2.958
Dividends	1,310,400	0.857
Profit and loss	767,544	0.502
Totals	$6,600,953	$4.317

The Spearfish hydro-electric plant is completed. During 1912 expenses on account of construction, which are included in "sundries" in the table of expenses, were $237,368. The biggest items were: Pressure pipe line, $125,044; Lead substation, $50,057; and $25,061 for power-house building and tail race.

Since the first of this year the monthly dividend rate has been increased to 65c. per share. In 1912 it was 50c. per share. At a meeting of stockholders in San Francisco, on Feb. 20, the capital stock was increased to $25,116,000; making an additional $3,276,000. At a meeting of the directors, held Feb. 25, it was decided to issue a stock dividend of 15%, to stockholders of record on Mar. 10. This will require the entire authorized issue.

The report of Superintendent T. J. Grier, which accompanies the fiscal statement, states that 914 lineal ft. of raises, 15,264 ft. of drifts and 550 ft. of shafts were excavated. There is broken in the mine, 2,030,217 tons of ore.

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The Hecla Iron Mining Co., one of the oldest companies in the Hanging Rock region in Ohio, has applied to the courts for dissolution. Its iron mines are worked out, its furnace has been abandoned for some years, but it has assets in land and timber which will pay a fair dividend to the stockholders. For many years Hecla was one of the best known charcoal furnaces of the region. The quality of the make was high and Hecla iron was used in casting most of the large Rodman guns which were used during the Civil War.

PERSONALS

J. F. Thorn has resigned as general superintendent of the Goldfield Consolidated Mines Co.

John D. Fields has returned to Butte, Mont., after a short visit to New York and Washington.

W. B. Orem, of Butte, has been appointed state inspector of mines of Montana for four years.

S. J. Lewis has removed his office from Guanajuato to Calle Gante, No. 14, City of Mexico.

Thayer Lindsley is making an extensive professional trip in the West and does not expect to return to New York until next summer.

R. E. Daniels, Chicago, has taken charge of the plant of the American Sintering Co., at Hubbard, Ohio, succeeding Charles H. Settel, deceased.

F. J. Grugan, of Philadelphia, is now resident manager for the Northern Ore Co., at Edwards, N. Y., having succeeded A. J. Moore in December last.

G. W. Thomson, late of Porcupine, Ont., has left London for Pahang, Federated Malay States, where he takes a position with the Pahang Consolidated Co. at Huantan.

B. Britton Gottsberger, general manager of the Miami Copper Co. property in Arizona, has undergone two operations for appendicitis and is expected to recover.

Francis A. Thomson has returned to Pullman, Wash., from a periodical inspection of the Silver Hoard mine at Ainsworth, B. C., for which company he is consulting engineer.

J. Hamilton Evers, of Denver, Colo., operating several mines in Gilpin County, has been missing since Feb. 4, when he left Denver to visit some mines in which he is interested in Mexico.

Hallet R. Robbins, recently of Atlantic, Wyo., has been appointed assistant professor of metallurgy at the State College of Washington, Pullman, Wash., in succession to the late R. E. Sampson.

George Bailey, president and general manager of the Central Consolidated mine in Nevada County, Calif., has given up the active management, and Paul Smith will hereafter have direct charge of the mine.

Edgar R. Braley, of Pasadena, Calif., has recently been elected a director of the Tom Reed Gold Mining Co., operating in Mohave County, Ariz. He succeeds D. A. Davis, formerly a large stockholder, who resigned to be rid of the labor of executive management of the mine.

H. B. Brooks, of the United States Bureau of Standards, has completed a study of the works of European manufacturers of electrical meters and similar instruments. His report is issued as a bulletin (special series No. 66) by the Bureau of Foreign and Domestic Commerce of Washington.

Willard J. Smith has tendered his resignation as superintendent of the Mohawk mine in the Lake Superior copper district, to take effect Apr. 1. Mr. Smith has been practically in charge of the work at this property since its beginning, first as engineer, and for a number of years as superintendent.

Dr. James H. Gardner, recently engaged in a survey of the Broad Top coal field for the Pennsylvania Survey, has resigned his position to form a partnership with F. Julius Fohs, the firm to be known as Fohs & Gardner, with offices in the Trust Company Building, Lexington, Ky. They will engage in the practice of commercial geology and mining engineering.

At a meeting of the directors of the American Iron & Steel Institute, held on Feb. 28, resolutions expressing the profound appreciation of the directors of the fidelity and skill by which James M. Swank discharged the duties of his office as secretary and general manager of the American Iron & Steel Association for many years, were adopted. The directors also paid a tribute to Mr. Swank as a man.

J. S. Williams, Jr., manager of the Moctezuma Copper Co., at Nacozari, Sonora, was wounded in the leg, according to press dispatches, during a fight between the Mexican Federals and rebels near Nacozari, on Mar. 8. The dispatches report that the rebel force largely outnumbered the rurales, who were garrisoning the town, and the latest advices were that they were closing in on the town, and were expected to take it.

David B. Reger has been appointed assistant geologist on the staff of the West Virginia Geological Survey. The position is a new one created by the recent session of the legislature. Mr. Reger served as field assistant on the United States Geological Survey from 1903 until 1906, as chief hydrographic surveyor at the United States Naval Station at Guantanamo, Cuba, in 1906 and 1907, and as field assistant on the West Virginia Geological Survey from 1908 until the present time. He is a graduate of the West Virginia University.

OBITUARY

Oscar Dana Allen died at Ashford, Wash., Mar. 5. He was at one time, from 1871 to 1887, professor of metallurgy and analytical chemistry at Yale University. Since he removed to the West he had been engaged chiefly in botanical studies and had written several monographs on the flora of Mount Tacoma.

John Mitchell Clark, one of the oldest and best known iron merchants and importers in New York, died at sea, Mar. 9, aged 65 years. He was born in Boston and was graduated from Brown University in 1865. He then entered the employ of Naylor & Co. and became the head of their New York business. He was president of the American Grondal Co., and of the Berkshire Iron Works.

Charles H. Graham died at Philadelphia a few days ago, at the age of 85 years. He was born at Canton, Ohio, and started in business life as a small greengrocer. In the early '80s he went to Leadville, Colo., and secured the A. Y. & Minnie claims, in which he interested Meyer Guggenheim, of Philadelphia. The mine turned out well, became a large producer, and yielded large profits to Messrs. Graham and Guggenheim. This was the introduction of the Guggenheims into the mining and smelting business.

Harry Jacobsen was caught in a snowslide near the property of the Mount Champion Mining Co., 16 miles from Leadville, Colo., on Feb. 25 and killed. He was a graduate of the Minnesota University School of Mines in the Class of 1910, and had since been engaged in engineering work in Colorado as assistant engineer of the Colorado Fuel & Iron Co.'s mines in the Walsenburg district; at the Liberty Bell Gold Mining Co.'s mine at Telluride and, at the time of his death, as engineer for the Mount Champion Mining Co., near Leadville. He was 25 years of age and was highly esteemed by many personal friends and by professional associates.

Col. Thomas Cosgrove, for the last 40 years superintendent of labor and transportation at the Edgar Thomson plant of the Carnegie Steel Co., at Braddock, Penn., and the oldest employee in point of service at that mill, died Mar. 2, at Pittsburgh. He was born in Scotland in 1845 and came to this country when a boy. He settled in the Pittsburgh district in 1865 and became a contractor, working on several railroads in the district. When Andrew Carnegie and his associates bought the site for the erection of the Edgar Thomson plant, Col. Cosgrove was appointed superintendent of labor, which position he had since held. Later, when Mr. Carnegie took in the junior partners, Mr. Cosgrove was given a large block of stock in the company.

SOCIETIES

American Society of Mechanical Engineers—At the local monthly meeting in New York, Mar. 13, the papers of the evening were "Eye Strain and Light," by Dr. A. M. Alger, representing the Sage Foundation for the Prevention of Blindness, and the New York Association of the Blind; "Industrial Lighting," by Ward Harrison, representing the Illuminating Engineering Society; "Industrial Safety," by Dr. W. H. Tolman, representing the American Museum of Safety. The society was also suitably represented.

American Institute of Electrical Engineers—A series of four lectures on the subject of Radioactivity is announced. They will be given by Prof. Edwin Plimpton Adams, of the Palmer Physical Laboratory, of Princeton University. The lectures will present a general survey of the history and important results of radioactive research and their bearing on modern electrical theory. The lecturer will assume that the hearer has no present knowledge of the subject. The date of the lectures are Mar. 19 and 26, Apr. 2 and 9, and they will be delivered at 8:15 p.m., in the auditorium of the Engineering Societies Building, New York.

INDUSTRIAL NEWS

At one time recently the Hardinge Conical Mill Co., 50 Church St., New York, had en route by water Hardinge mills for Russia, Italy, Bolivia, Chile, Mexico and Alaska.

The Consolidated Mining & Smelting Company of Canada is to install two Wedge roasting furnaces, which will be of seven hearths each, the hearths to be 20 ft. in internal diameter.

A. Milne & Co. have moved into their new offices and building at 741-745 Washington St., New York. This new building was built especially for the handling of Fjab steel, a full stock of which will be carried at all times.

The Meade-Morrison Manufacturing Co., which specializes in coal handling machinery and steel and electric hoists, has purchased 10 acres of land on the Boston & Albany R.R. in East Boston, where it will erect a new manufacturing plant, the facilities of the present plant in Cambridge having been outgrown.

The Taylor-Wharton Iron & Steel Co. announce that H. A. Johann and Martin O'Shaughnessy, having resigned effective Mar. 31, 1913, to engage in other business, the Chicago office of this company will be in charge of Geo. R. Lyman and J. R. Bolgiano, with Guy H. Bergen, representing the company particularly in the Mesabi Range district.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penn., recently installed two unusually large direct-current generators at the Canal Road plant of the Cleveland Electric Illuminating Co., Cleveland, Ohio. These are 3750-kw., 275-volt, 180 r.p.m., shunt-wound generators driven by steam turbines through Westinghouse reduction gears with a 10:1 ratio.

The T. L. Smith Co. held a reunion of its staff at Milwaukee, Wis., on Feb. 26 and 27, the special occasion being the formal opening of the new office building of the company, which is situated just across the street from its present shops. T. L. Smith, president of the company, related the history of the Smith mixer and George Hubbell gave a description of the Symons gyratory crusher.

The annual meeting of the stockholders of the Goulds Manufacturing Co. was held at Seneca Falls, N. Y., Feb. 24, 1913. No change was made in the board of directors and the following officers were re-elected: President, N. J. Gould; vice-presidents, D. V. Colby, W. D. Pomeroy, W. E. Davis, W. E. Dickey; secretary, H. S. Fredenburg; treasurer, B. R. Wells; assistant treasurer, E. W. Medden.

The American Manganese Bronze Co. has received a contract for manganese bronze shaft caps for the Catskill Aqueduct. These are to be used on the tops of risers from the 14-ft. water distributing tunnel. Six of these caps are to be of 72-in. inlet with two 48-in. outlets, each cap weighing over 25,000 lb., which is considered to be the largest manganese bronze casting, other than propeller wheels, ever designed.

The March bulletin of A. Leschen & Sons Rope Co., St. Louis, Mo., contains an article emphasizing the value of correct wire-rope lubrication. A successful wire-rope lubricant must not only act as an oil for the points of friction, but must also protect each wire from the effects of water, acid, etc., and to do this it must penetrate. Each class of wire-rope service demands a special lubricant for best results.

The H. W. Johns-Manville Co., New York, is marketing a new coupling known as the J-M flexible metallic combination hose for steam and pneumatic service, which is designed to prevent kinking, collapsing and puncturing. The connector consists of a good grade of rubber hose protected against outward injury by a stout metal armor. It is said to resist a crushing strain of 300 to 800 lb. to each four turns of the spiral forming the armor. Specially designed couplings of malleable iron or brass are furnished with each length of hose. This hose can be furnished in any length with inside diameters up to 12 in. for all working pressures. It is also made with an inside pressure-tight metallic lining as well as an outside armor for suction service.

A stoping machine drill adapted to drifting purposes is put upon the market by the Sullivan Machinery Co. The difficulty or impossibility of drilling flat holes with the ordinary stoper and solid steel is well recognized. In this new machine, called DC-21, hollow steel is employed and the holes kept clean of cuttings by means of an air jet. In construction the machine does not vary greatly from the standard stoper types, but has its nose bushings unusually long so as to counteract the excessive pressure and wear obtained at this point when drilling flat holes. Live air is diverted by means of a narrow port to a small tube in the drill head which passes through piston and striking block and conducts the air into the hollow steel. A controlling valve is provided to adjust the admission of air. Inasmuch as the expulsion of the rock cutting by compressed air produces an abnormal amount of dust in the working place, the Sullivan stope-drill atomizer is a device particularly applicable to this type of hammer drill. It is an attachment weighing about 3½ lb., placed between the inlet bushing and the hose connection, and is readily applied or removed from the machine. When air is turned on, a small quantity is used to draw water from a pail or other convenient supply on the injector principle, and force it in the form of a spray against the mouth of the drill hole. Water under pressure is not necessary, the only additional equipment consisting of a short piece of small diameter hose and a pail of water.

TRADE CATALOGS

Buff & Buff Mfg. Co., Boston, Mass. Catalog. Transits and levels. Illustrated, 118 pages, 6x9 in.

The Scranton Acetylene Lamp Co., Scranton, Penn. Booklet. Scranton mine lamps. Illustrated, 3½x6 in.

Rateau Steam Regenerator Co., 90 West St., New York. Catalog. Steam regenerators. Illustrated, 24 pages, 9x11 in.

Denver Engineering Works Co., Denver, Colo. Bulletin No. 1058. Stamp mill machinery. Illustrated, 24 pages, 8x10½ in.

Alberger Pump & Condenser Co., 140 Cedar St., New York. Bulletin No. 100. Hammond water meter. Illustrated, 8 pages, 8½x11 in.

Power and Mining Machinery Co., Cudahy, Wis. Bulletin No. 41. Stamp mills. Illustrated, 62 pages, 6x9 in. Bulletin No. 16. Copper converters. Illustrated, 32 pages, 6x9 in.

Crocker-Wheeler Co., Ampere, N. J. Bulletin No. 153. Direct-current lighting and power generators. Illustrated, 16 pages, 7½x10 in. Bulletin No. 154. Oil-insulated, self-cooled and water-cooled power transformers. Illustrated, 12 pages, 7½x10 in.

Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3008. Class "PE" direct connected electric-driven air compressors. Illustrated, 40 pages, 6x9 in. Form No. 575. Instructions for installing and operating Class "PE" air compressors. Illustrated, 28 pages, 6x9 in.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ROCK-CRUSHING MACHINERY. Jean Riberyron, Sosnowice, Russia. (U. S. No. 1,053,220; Feb. 18, 1913.)

ROASTING—Improvements in Apparatus for Roasting or Sintering Ores. J. E. Greenawalt, Denver, Colo. (Brit. No. 14,805 of 1912.)

ELECTRIC FURNACES—Improvements in and Relating to Electrical Furnaces. I. Rennerfelt, Halmstad, Sweden. (Brit. No. 7367 of 1912.)

ORE REDUCTION—Reducing ore by Means of Solid, Carbonaceous Material. Sven Emil Sieurin, Höganäs, Sweden. (U. S. No. 1,054,873; Mar. 4, 1913.)

ELECTRIC FURNACE. Thomas B. Allen, Niagara Falls, N. Y., assignor to the Carborundum Co., Niagara Falls, N. Y. (U. S. No. 1,054,280; Feb. 25, 1913.)

ORE REDUCTION—Process for Reduction of Ores. George Frederick Rendall, New York, N. Y., assignor to R. W. Priest, trustee, New York, N. Y. (U. S. No. 1,053,436; Feb. 18, 1913.)

SHAFT SINKING—Improvements in or Relating to the Congealing of Shifting Sand in the Sinking of Mine Shafts. Evence Coppee Fils, Ressaix, Belgium. (Brit. No. 23,857 of 1912.)

CRUSHING—Ball or Pebble Mill. George Fountaine Weare Hope, Stanford Le Hope, and Harold William Joshua Cheffins, Seaford, England. (U. S. No. 1,054,415; Feb. 25, 1913.)

ORE REDUCTION—Furnace for Reduction of Ores. George Frederick Rendall, New York, N. Y., assignor to R. W. Priest, trustee, New York, N. Y. (U. S. No. 1,053,435; Feb. 18, 1913.)

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—MAR. 6

The Legal Contention of the Farmers Against the Selby Smeltery in Solano County, has been practically ended by the selection of a commission of three experts, agreed upon by the county board of supervisors and the Selby Smelting & Lead Co. to decide future questions of annoyance and public nuisance resulting from escaping smeltery fumes. The men selected for this commission are Dr. J. A. Holmes, of Washington, director of the U. S. Bureau of Mines; Dr. W. F. Snow, of Sacramento, secretary of the California State Board of Health; Dr. Ralph A. Gould, of San Francisco, former chief of the Pacific Coast branch of the National Bureau of Pure Foods, and recently employed as determinative chemist by the Shasta County farmers in their actions against the Balaklala and Mammoth smelteries. It is probable that similar action will be taken by the boards of supervisors in other counties, where copper smelting has been almost wholly suspended by the courts upon complaints of the farmers.

For the last eight or nine years the farmers of Shasta and Solano Counties have been at war with the smelters, and in later years the complaints have extended to Calaveras and adjoining counties. Large amounts of money have been expended in litigation; the smelters have made costly improvements and paid out large sums in damages; smelteries have been closed down permanently or temporarily; and besides these losses to corporations and individuals the gold and copper mining industries have been hampered, with resultant losses in the total mineral production of the state. In Solano County the district attorney's office has given 18 months almost exclusively to the complaints of the farmers against the Selby smeltery; and the county has expended $25,000. The Selby company has, in the last seven years, paid out in court costs, attorney fees and compromises with the farmers a total of about $50,000. While the smeltery has not been permanently closed or put wholly out of commission continuous operation has been interrupted and the business greatly hampered by the necessity for obedience to a restraining order of the superior court that prohibits the company from allowing supposedly noxious fumes to be emitted from the stacks of the smeltery during the period from Mar. 15 to Oct. 15 each year. This is the period when the trade winds carry the smoke westward from the smeltery at Vallejo Junction through the Karquines strait to Benicia and the farming lands in the vicinity. The fumes complained of by the farmers are lead dust, sulphuric acid and sulphur dioxide. The lead dust was eliminated by the installation of a baghouse five years ago; a year later the Cottrell electric process was developed to eliminate sulphuric acid fumes. The escape of sulphur dioxide has been largely reduced by the diversion of a proportion of the sulphide ores to the sulphuric-acid plant at Peyton in making sulphuric acid before going to the smeltery for the recovery of gold. Thus the three elements of annoyance complained of by the farmers are so far controlled that the official representatives of Solano County are satisfied to leave the question of future complaint to the commission of experts. The annual production of gold, silver, copper and lead by the Selby Smelting & Lead Co. amounts to more than $50,000,000. The pay roll of the smeltery is about $300,000 a year. A large proportion of the precious metal-bearing ores are received from Nevada, Alaska, Canada, Mexico, Central and South America. To reduce the operating time of the smeltery to four months per year would be paramount to putting the plant wholly out of commission; and should this be accomplished by the complaints of the farmers of Solano County the farmers in other counties where there are smelteries would not rest until every plant in the state was closed down. The natural and physical conditions in the various localities where smelteries are operated are sufficiently similar to the conditions at the Selby plant to support the belief that what may be accomplished in Solano County by the employment of expert knowledge in deciding the question of annoyance and public nuisance complained of, may be as readily accomplished in Shasta, Calaveras, Amador and San Joaquin Counties.

Since the farmers are demanding that the counties take up the burden of complaint against the smelters it is reasonable that the county supervisors should adopt the same method of placing the matter in hands of men whose knowledge is equal to the task.

DENVER—MAR. 7

New Ore Has Been Found at Camp Bird. The deep development work recently reached the vein and good ore was found. The oreshoot of which this discovery is a part was cut in winze 527 east. A shaft known as No. 3 was subsequently sunk from the third level east, at crosscut south No. 11. This shaft is vertical. It passed through the vein above the fourth level, and was about 40 ft. in the foot wall at the fifth level. The ore having been found continuing, and even growing richer on the fifth level, which was reached in December, the shaft was continued to establish a sixth level, about 200 ft. lower. The drifting from the shaft to the vein, a distance of about 100 ft., was considerably impeded by the necessity of heavy pumping equipment, but the vein was finally reached, and the ore found. This point is about 900 ft. below the third level, and about 1400 ft. below the surface. It is the greatest depth at which ore has been discovered in the Camp Bird mine.

The Recent Discoveries of Silver Ore at Eagle, when considered away from the enthusiasm and excitement of the camp, do not yet seem to warrant the assumption that Colorado's long-sought new mining camp has at last been discovered. The facts so far determinable are that while many large specimens of extraordinarily rich silver ore have been found, the vein material as a whole is spotty, the silver being erratically distributed so that while one sample may show upon assaying a tenor of 1000 oz. of silver per ton, another, taken but a few feet away, may prove to be of unprofitable grade. The occurrence signifies that much actual exploration must be done before dependence can be placed upon the persistency of the deposits. The formation of the region consists largely of shale, and shaly sandstone, with occasionally limestones, all associated with basalt, gneisses, shists and granites. The ages range through Jurassic, Triassic, Carboniferous, Devonian, Ordovician, Cambrian and Pre-Cambrian. The silver deposits seem to be confined to those rocks that are not older than the Carboniferous. These considerations coupled with the fact that the ground has been covered with snow make it advisable to receive with reserve and moderation the many glowing accounts of the camp that have been so widely circulated. In a word the actual worth of the sandstone ores can only be proved by work after the snow is off the ground and furthermore it may be said that the occurrence of persistent deposits of metallic ores in sandstones is not common enough to warrant too much optimism. However, great excitement prevails at Eagle, where two more new strikes of silver-vanadium ore are reported to have been made. The Flying Dutchman claim, with a vein two feet wide, has been located one-fourth mile east of the original strike in the Lady Belle, on Horse mountain. The ore has limestone and sandstone base, but it is more highly mineralized than that taken to Denver from the Lady Belle several weeks ago. W. A. Gesner has opened a vein in his Sunnyside claim, located about three miles east of Horse Mountain.

BUTTE—MAR. 3

An Inspection of Power Plants at Great Falls was recently made by Max Hebgen, general superintendent of the Montana Power Co. Mr. Hebgen stated that work will be commenced within a month upon the construction of the power line which is to supply the Sun River irrigation project with electric power, the work to be completed by Sept. 1. The distance covered will be about 90 miles, and several towns along the route will be suplied with power.

Fire Destroyed the Laboratory at the Boston & Montana smeltery at Great Falls, Mar. 2, entailing a loss of about $25,000. It is believed that spontaneous combustion was the cause of the conflagration as the building had been unoccupied by any of the working force since the night before. Considerable of the equipment, including balances and platinumware, was saved. Temporary quarters will be used until a new building can be erected, which will require a month or six weeks.

In the Anaconda vs. Butte & Ballaklava Suit a decision was handed down Mar. 3, by Judge Lynch, of Butte, denying the request of the defendant company for a change of venue. The injunction suit which has been pending for more than two years, was brought by the Anaconda company against the

Butte & Ballaklava company on the grounds that the principal vein being mined by the latter company, apexed on the former's ground. In its answer and cross-complaint, the defendant claimed ownership of the apex, and demanded damages for ore which it was alleged was mined by the Anaconda company in previous years. After a lengthy legal battle the motion for a change of venue was made by the defendant company upon the grounds that a fair trial was impossible in Silver Bow County, and a number of affidavits were made by former employees of the Butte & Ballaklava supporting this contention. In his decision Judge Lynch stated that neither party was entitled to a jury trial for the reason that the main question to be decided was of an equitable character, and that a change of venue to another county was not justifiable. Exceptions to the ruling of Judge Lynch were taken by R. L. Clinton, attorney for the defendants, and he was given 30 days in which to prepare and serve a bill of exceptions.

Preparations for Drilling for Gas and Oil Near Hardin in Yellowstone County are being made. The drill is on the ground ready for use, and a force of men is engaged in erecting a derrick with which to operate it. It is calculated that seven days will be required for the work, after which the drill will be placed in operation. The field has been thoroughly examined by experts and it is believed that gas in commercial quantities will be encountered within a depth of 2500 ft., when it is planned to pipe the flow to Billings and other towns in the vicinity.

SALT LAKE CITY—MAR. 7

The Ferry Appropriation Was Cut in Half in the upper house of the Utah legislature, from $15,000 to $7500. The bill introduced by Sen. W. Mont Ferry provided for mining experiments and research at the school of mines of the University of Utah, and was strongly urged in committee by Prof. J. F. Merrill of the school of mines. Senator Ferry pointed out that the volume of mining business in Utah amounted to $50,000,000 per year, while the agricultural industry rolled up a total of about $35,000,000. The importance of the mining industry, he said, demanded consideration of this measure.

Electrical Equipment is being used by an increasing number of Utah mines. The smaller companies are replacing steam-driven hoists and compressors with more effective and less cumbersome electrical machinery. while at the larger properties constant improvements in power arrangements are being made. The Utah Copper Co. will operate the Arthur and Magna mills with hydraulically developed electric power, using about 14,000 hp. The company has six electrically driven compressors at its mine at Bingham. The mill, compressor and blowers at the Utah Apex are driven by motors, and the company has recently installed an underground electric haulage system. Electrical equipment is in extensive use at the Ohio Copper mine and mill, and at the Utah Consolidated. Eight Tintic properties have equipped their shafts with electrical hoisting machinery. Among the most recent to electrify its plant is the Victoria, and the Iron Blossom has recently installed new electrical equipment at its No. 1 shaft. The Daly-Judge mine and mill at Park City and the Silver King Coalition use electricity for power, hauling, pumping, etc. Electricity is used at the Ontario mill. The Bonneville Tunnel Co. at Springville and the Union Chief at Santaquin, both run compressors with electric power. At Ophir, the Cliff has recently installed an electric hoist, and the Ophir Hill mine and mill uses electric power from a hydro-electric plant of its own. In Beaver County, the South Utah and Majestic use electricity. The Garfield smeltery and the International smeltery at Tooele make extensive use of electrical power.

JOPLIN, MO.—MAR. 7

Ore Prices Have Advanced considerably during the last week, due mainly to the increased demand for spelter. Relying on the present prospects, practically all the mines of the Webb City-Carterville district which closed down temporarily will soon resume operations. Prospecting has been going on all over the district and several rich strikes are reported.

GLOBE, ARIZ.—MAR. 4

The Arizona Commercial Has an Option to purchase 400 acres of mineral land at Globe, near the present workings of the company, and adjoining the United Globe and Old Dominion mines. The property was optioned upon the recommendation of the company's geologist. Except for a small payment to bind the bargain no money will be required for two years, in which time the company will have the privilege of developing the new property, and any ore which may be extracted during this period will belong to the company. If developments are favorable a final payment will be made; otherwise the option will lapse. The shaft is now 60 ft. below the eighth level and is being sunk steadily. Developments of the Copper Hill end of the property have recently resulted in a very promising body of sulphide ore being opened on the eighth level.

CHEYENNE, WYO.—MAR. 7

The Union Pacific R.R. Was Forced to Relinquish to the Government, title to coal lands near Hanna, valued at $3,000,000, on the ground that the property was obtained by fraud and misrepresentation. The suits filed against the railroad by the Government at Cheyenne came to an unexpected close when attorneys for the road filed stipulations confessing judgment. Federal Judge Riner entered decrees restoring the lands to the public domain. "Dummy" entrymen testified that they turned over their lands for a nominal consideration.

Penn-Wyoming Stockholders Will Be Unable to Realize on their holdings in the Penn-Wyoming and its subsidiary companies. A decision rendered by Judge John A. Riner of the U. S. district court of Wyoming, which decrees that the property of the companies, as represented by first mortgage bonds aggregating $3,368,500, shall go to satisfy a trust deed held by the Continental & Commercial Trust & Savings Bank of Chicago. The property involved in the litigation is in Carbon County, and at one time was valued at not less than $10,000,000, but now its actual worth is so problematical that it is considered doubtful if the first mortgage bonds, which it carries to the amount of $3,368,500, can be sold for the minimum price demanded by the court, one-fourth of their par value or $842,125. It includes the famous Ferris-Haggerty copper mine, an aërial tramway which at the time of its construction was claimed to be the longest in the world, the Encampment smeltery, the Saratoga & Encampment R.R., the Encampment water-works and lighting systems, the Encampment townsite, the coal mines at Carbondale and the copper mine at Battle Lake. Judge Riner has appointed Edward W. Stone, cashier of the Citizens National bank of Cheyenne, special master in chancery, to sell at auction to the highest bidder, the first mortgage bonds given as security for the trust deed executed to the Continental & Commercial Trust & Savings Bank by the United Smelters, Railway & Copper Co., the successor of the Penn-Wyoming Copper Co. The following mortgage bonds will be disposed of, either in parcels or en bloc: Saratoga & Encampment Ry. Co., $518,500; Encampment Smelting Co., $500,000; Encampment Pipe Line & Ditch Co., $100,000; Encampment Tramway Co., $350,000; Encampment Waterworks Co., $50,000; Encampment Land & Town Lot Co., $8,000; Battle Lake Tunnel Site Mining Co., $750,000; Haggerty Copper Mining Co., $1,000,000; Carbondale Coal Co., $20,000; North American Mercantile Co., $22,000; and Emerson Light Co., $50,000; a total of $3,368,500. The order for the sale specifies that all right, title and interest of the Penn-Wyoming Copper Co., and its successor, the United Smelters, Railway & Copper Co., in the securities listed shall cease forever. This means that the stockholders in the companies in the names of which the bonds were issued will receive nothing in return for their investment unless they buy in the bonds, satisfy the creditors and make the enterprises pay, a practical impossibility owing to the immense capitalization of the various companies concerned. A conservative estimate of the stock held is about $25,000.000. It will be at least a month before the special master in chancery offers the first mortgage bonds for sale, and it is probable that it will take some time to dispose of the bonds.

COBALT—MAR. 7

A Verdict of Criminal Negligence was returned at the inquest following the death of Thomas McAndrews who was killed at the Alexandria mine a short time ago by being struck by a falling crosshead. Evidence showed that several of the regulations of the Mines Act had been disregarded, such as posting notices, prohibiting the men from riding the bucket and the use of a safety device on the crosshead. The absence of this last precaution was responsible for the death of McAndrews. Following the delivery of the verdict, the coroner issued a warrant for the arrest of E. W. Beidler, manager of the Alexandria mine, on the charge of manslaughter; he was subsequently released as the coroner's jury held the "management" responsible, no name being mentioned.

VANCOUVER, B. C.—MAR. 4

All the Placer Gold from the Yukon Fields and the entire province of British Columbia will be received here, it is expected, as a result of an order issued at Ottawa, abolishing the assaying and stamping charges of ⅛%. In consequence of the order, this city is placed on an equality with Ottawa and San Francisco in the matter of assay-office charges.

THE MINING NEWS

ALASKA

KOBUK JADE—Chinese are negotiating for the purchase of this property from the owner, Walter Koon.

ALASKA GASTINEAU—A 200-hp. motor and three 100-kv.-a. and three 150-kv.-a. transformers have been ordered from the General Electric Co.

MOUNTAIN KING—The first stamp mill in the Mineral Creek district is being built at this property near Valdez leased recently by California oil men. Compressors and drills are now on the way to the property.

RHOADS-HALL—The lower level was flooded for several days in January, due to a breakdown of the pump. This will soon be in commisison again, and work on the 70-ft. level will be resumed A new 30-hp. boiler has been installed to relieve the other one while it is being repaired. A 6-ft. Risdon-Johnson vanner has been set up, but it will not be placed in continuous operation until some minor repairs have been made. The mill has not been run steadily for some time, chiefly on account of a scarcity of ore. Several new stopes were opened on the 70-ft. level, but the flooding has prevented regular production.

DUNCAN M. STEWART WAS FREED because of the statute of limitations. He was one of six defendants in the $10,000,000 Alaska land fraud conspiracy case, on trial before Federal Judge Landis, and had entered into the alleged conspiracy with Albert C. Frost and other defendants, according to the Government, but withdrew early in 1907. The indictments were returned in 1911, when the statute's three-year period had run. The other defendants are now being tried. The charge is conspiracy to defraud the Government out of 10,000 acres of Alaska coal lands by means of dummy entrymen.

CALIFORNIA

Amador County

SOUTH EUREKA—New timbering in the caved shaft is progressing at the rate of about 20 ft. per day. The air is improving.

CENTRAL EUREKA—The repairs to the shaft, necessitated by the caving, is requiring careful engineering, for the reason that the drop of the hanging wall was of great length and carried heavy material. James A. Davis, of Sutter Creek, is superintendent.

Eldorado County

INTERVALLEY—This mine has been reopened. Bruce McBeath, of Placerville, is superintendent.

GOPHER-BOULDER—This mine at Kelsey has been unwatered and is being sampled. Mr. Bell, of Kelsey, is superintendent.

THE SIERRA WATER SUPPLY CO. ditch is out of commission temporarily, and a number of mines in the vicinity of Placerville dependent on the ditch for water have reduced operations.

Inyo County

SKIDDOO—The repair of the 29-mile pipe line, which was burst in several places during the cold weather in Januray, will begin about Mar. 1.

SALINE VALLEY SALT CO.—The reports of White Smith, president, and D. H. Kuhnle, superintendent, have been distributed to the stockholders. The greater part of the grinding machinery for the plant is on the ground at the terminal near Swansea, and the tramway will be in operation in about 60 days.

FOUR METALS MINING CO.—There have been several efforts of men interested in this company's operation of the Cerro Gordo mine to straighten out the legal tangle. It was twice reported in 1912 that the debts had been settled and the mine put in operation. A scheme of reorganization is being planned. The unsecured creditors have recently forced the company into bankruptcy. The mine was formerly a large producer of lead, zinc, silver and gold, and it is believed could again be made to pay if properly managed. Louis D. Gordon holds a lease on the mine. A suit has been brought in the Superior Court of Santa Clara County to cancel the lease. A suit has also been brought to annul the $250,000 bond issue.

Kern County

THE THIRD GOVERNMENT SUIT testing the validity of President Taft's withdrawal order of Sept. 27, 1909, is on file in the U. S. District Court. The Consolidated Midway and other oil companies are named as defendants. The defendants are alleged to have entered on the land after the issuance of the withdrawal order and to have no right to the territory. The land the government seeks to recover consists of 160 acres, valued at $1,000,000.

Nevada County

OSCEOLA—A strike of specimen ore was recently made. Development work is being done. E. W. Tarr is manager.

GOLDEN GATE—A new shoot of ore has been opened above the 1030-ft. level and the 10-stamp mill is running three shifts. Robert Nye is manager.

UNION HILL—Work on company account has been stopped temporarily but the 20-stamp mill is being kept running on ore taken out by lessees. Cliff Graham is superintendent.

GOLD MOUND—This mine, three miles west of Grass Valley, has been pumped out and thoroughly examined. The shaft is now down 200 ft. and will be sunk an additional 500 ft. W. F. Leete is manager.

BRUNSWICK—The raise from the 1250-ft. level has been connected with the new vertical shaft 400 ft. from the surface. The shaft, 8x18 ft., was sunk 400 ft. when work was stopped by the large amount of water encountered. A drift was driven from the 1250-ft. level and a raise 5x12 ft. lifted to the bottom of the new shaft. The raise will now be enlarged to correspond with the new shaft and sinking will be continued to the vein, which will be about 200 ft. This new vertical shaft is 3000 ft. from the old incline. A 1500-cu.ft. compressor has been ordered and will be placed at the mouth of the new shaft, also a 20-stamp mill. Work will be carried on through both shafts. C. H. Mallen is manager.

San Bernardino County

CALIFORNIA TRONA CO.—Proofs of labor have been filed on 209 claims which the courts have decided are owned by this company at Searles Lake.

COLORADO

Clear Creek County

CHAMBERLAIN-DILLINGHAM ORE CO.—The sampler is operating day and night at full capacity.

IDAHO-BRIDE—The drift on the Seaton vein from the Newhouse tunnel is developing a 4-ft. vein of $10 ore.

LONE TREE—This property between Lamartine and Freeland has been secured under bond and lease by E. M. Moscript, of Idaho Springs.

QUITO—This Chicago Creek property will be unwatered in the near future in order that an examination may be made to determine the advisability of further development.

STANLEY—During February the Fifth Level West heading was advanced 107 ft. to a total length of 1980 ft. A water course has been cut which flows at the rate of 10 gal. per min. The vein beyond this crevice is wider than the drift and will be prospected by crosscutting.

BELMAN—This property is operated through the Big Five tunnel, which comes into the mine at a distance of about 9000 ft. from the portal and 2200 ft. below the outcrop of the vein. The Belman vein is probably a westerly extension of the Gem vein. It has been stoped for a height of 300 to 400 ft. above the tunnel level. At present a winze is being sunk on the vein which is about 30 in. wide and assays from $30 to $40 per ton. The winze is down 60 ft. and will be sunk to a depth of 80 or 100 ft. before drifting will begin. The company is contemplating the construction of a two-compartment raise on the vein from the tunnel level to the surface, to prospect unexplored territory and to insure economical operating.

GEM—All ore mined above the Newhouse tunnel is raised through the two-compartment inclined shaft. The distance from the tunnel connection to the surface is 1850 ft. Whenever convenient the two skips are operated in balance. The new brick shaft house at the surface is equipped with a double drum hoist operated by compressed air. The Ingersoll-Rand compressors are motor driven. The new headframe is built of structural steel. The workings above the tunnel are producing about 100 tons per day. The ore assays from ½ to 1 oz. gold, 15 to 20 oz. silver and about 20% lead. The east drift on the tunnel level is being overhauled and retimbered preparatory to resumption of mining in some of the old stopes which contain $8 to $15 ore. The vein near the tunnel intersection is from 20 to 50 ft. wide and the richest ore is found near the walls. The operators contemplate mining a substantial tonnage of low-grade oxidized ore as soon as the cyanide department of the new Argo mill is ready to receive it. This low-grade ore is estimated to average $6.50 per ton; principally in gold and silver. During previous mining operations in this ground filled stopes were carried and at this time the broken reserve is estimated at 4000 tons. In the west drift a winze has been sunk 50 ft. in ore assaying $20 to $30 per ton. The winze will be sunk about 100 ft. whereupon drifting and stoping will commence below the Newhouse tunnel level. W. E. Renshaw is general manager.

Fremont County

THE ZINC SMELTERY at Cañon City, which has been idle for more than two years, has been leased and is being prepared for the resumption of operations.

Gilpin County

FRONTENAC—This and the Aduddell are operated together, the underground workings of the two mines being connected. The production ranges from 100 to 125 tons per day. The ore averages about $10 per ton. It is hoisted through an incline shaft by a bucket sliding on skids, is dumped into a bin, and fed to an endless iron conveyor from which the smelting and milling grades are classified by hand sorting. The milling ore is transported by tramway to the Frontenac mill below Black Hawk. Development work is being performed in two different levels, amounting to 100 to 150 ft. of drifting per month. N. H. Brown is manager.

Lake County-Leadville

FAIRPLAY—The new ore recently opened in the drift to the east of No. 2 shaft is increasing in size with driving. Work has been resumed in the drift to the west of the shaft.

AMIE—Lessees have opened three different streaks of ore at the 200-ft. level. One streak is about 3 ft. wide, and is rich in silver and lead. The others are smaller, and all are of inconstant width.

CHRYSOLITE—The drift to the west of the shaft has been driven into rock that resembles white porphyry, but assays show silver. Some of the old workings were driven through this formation and evidently it was considered waste as it was left standing. Two cars have been mined and will be shipped soon.

San Juan Region

TOMBOY—In February 10,500 tons of ore yielded $87,000 in bullion and concentrate; $39,500 was net profit.

CAMP BIRD—A crosscut on the sixth level cut a large vein, three feet of which assays $25, the remaining portion of the vein being barren.

CENTRAL COLORADO POWER CO.—A revised plan of reorganization has been filed with the Columbia Knickerbocker Trust Co., New York, and Commonwealth Trust Co., Boston.

Teller County-Cripple Creek

VINDICATOR—A strike has been made on the 1600-ft. level, the ore assaying $30, and being 10 ft. wide in places.

STRATTON'S INDEPENDENCE—In January, the mine produced 3312 tons of $10 ore, and 10,800 tons of low-grade mine and dump ore was milled. The net working profit was $11,632 for the month.

REX MINING & MILLING CO.—This company, formed May 12, 1911, has been filed for record with the county clerk and recorded; it is capitalized at $500,000, shares $1 par. The directors are John Sharpe, H. J. Gehm, A. A. Hollestone.

EL PASO—The new shaft, known as the Nichols shaft, so named after the superintendent of the property, is in full operation, even to the ore house. From it two cars of ore per day are being shipped, while three cars per day are being marketed from the old ore houses.

THE OUTPUT OF THE GOLD ORE for the Cripple Creek district for February, was 62,575 tons, worth $1,070,959 gross, or only 4055 tons and $53,587 less than that of the 31 days of the previous month. The heavier tonnage in February, 1913, as compared with that month in 1912 is due to greater shipments of low-grade ore to the local mills.

DELAWARE

Newcastle County

PLATINUM AND GOLD are reported to have been found at the old iron pits on Chestnut Hill near Newark. Methods for their recovery are being tested. W. N. Scott is in charge of the mine, which is being financed by Philadelphia men.

GEORGIA

Gordon County

SUGAR VALLEY BROWN ORE MINING CO.—This company has been organized with $100,000 capital; F. D. Martin, president, and has bought 760 acres of ore-bearing land in the vicinity of Sugar Valley. A standard-gage railroad will be built to the property, and plans for buying equipment are now being made. Prospecting work on a large scale has shown the existence of a large body of ore assaying from 50% to 55% metallic iron. It is claimed that about 2,000,000 tons of ore are now in sight.

IDAHO

Lemhi County

MUSGROVE MINING CO.—The new boiler will be set and the mill will be running 24 hr. per day in the near future. Ore assaying $40 in gold was recently broken in the mine. A cyanide plant is in operation in connection with the mill. R. L. Edwards is manager.

A COPPER PROPERTY ON BOHANNON CREEK is being developed by Frank Miller, associated with Great Falls, Mont., men. He reports that within 30 days a trial shipment of 25 tons of high-grade ore will be made to the Great Falls smeltery. The ore is chalcopyrite and bornite, carrying gold and a little silver. There now is two feet of shipping ore in the face of the tunnel.

THE CONTRACT FOR HAULING NEW DREDGE MACHINERY to Bohannon Bar has been let, and also a contract signed with local company for power to commence Aug. 1, 1913. The Yuba Construction Co. has the contract for building the boat and placing the machinery. Due to this power contract, the local power company has commenced plans to increase its hydro-electric output. The company is supplying Salmon City with more than 200 kv.-a., and the Kirtley Creek dredge with 400 kv.-a., from its two plants near the city limits.

LOUISIANA

Calcasieu Parish

MARTEL SYNDICATE—This company has been organized to prospect for petroleum in the Jennings oil field.

GULF REFINING STAR CO.—A 12,000-bbl. gusher is reported to have been brought in on the Vincent tract in the Vinton field.

Catahoula Parish

A LARGE TRACT OF LAND ON SICILY ISLAND has been purchased by a Texas syndicate, and boring for oil will be started imediately. Some of this land had been previously bored for oil; gas was encountered but funds were exhausted before oil was discovered.

MICHIGAN

Copper

SOUTH LAKE—The shaft at this property is being sunk through an amygdaloid formation streaked with copper at a depth of about 300 feet.

ONECO—Operations at this property are centered in drifting south at the 11th and 12th levels, where the drifts have been extended about 450 ft. from the shaft. The ore recently opened has been uniform, but of a low grade. Drifting is also in progress at the third level north.

LA SALLE COPPER CO.—The unwatering of the two shafts on this company's tract is progressing favorably and will probably be completed about Apr. 1. No. 1 shaft is 2100 ft. deep, and the ground is extensively opened so that as soon as the workings are cleaned out ore shipments can be maintained. No. 2 shaft is down 1800 ft., and sinking will be resumed.

NEW BALTIC—Shaft sinking is progressing satisfactorily at this property at a depth of about 425 ft. The shaft will continue to a depth of about 1500 ft., and at a depth of 500 ft. a station will be cut and a crosscut will be driven to open the two parallel formations. The shaft is being sunk in the middle of a series of three copper-bearing formations. The surface equipment is sufficient to sink the shaft down to the planned depth.

Iron

M. A. HANNA & CO.—This company, which is developing the new Carpenter mine at Crystal Falls, has sunk the wooden drop shaft, 12x18 ft., to bedrock through 85 ft. of overburden. The shaft was started late last summer and preparations were made to handle a large flow of water by installing adequate boilers and pumps, but contrary to expectations only a comparatively small amount of water was encountered. The shaft will be continued in the rock, but it is not likely that more than a sample shipment of ore can be made in 1913.

MINNESOTA

Cuyuna Range

COMBINATION IRON CO.—A belt of rich ore has been found on the property of this company near Cedar Lake, and plans are being made for starting mining operations immediately.

Mesabi Range

PITTSBURGH IRON ORE CO.—A 500-kw. Curtis turbogenerator will be installed at this company's mine at Iron Mountain.

SECTION FOUR—A shaft has been sunk to a depth of 50 ft. since Jan. 20, at this mine, near Ely Lake, and taconite and lean ore have been penetrated.

BRAY—Work on the shaft and the installation of machinery has been nearly finished, and when the ore season opens, it is expected that a large tonnage will be shipped from the shaft. Stripping operations were begun Mar. 1.

ARTHUR IRON MINING CO.—The property directly south of the Buffalo-Susquehanna pit, and within the village limits of Hibbing, on the southeast, between the village proper and Brooklyn addition, will be developed to determine the extent of the ore deposit. This property will probably be worked as an underground mine. Although the property was drilled several years ago, it will be drilled again to definitely determine the outline of the ore deposit.

MISSOURI

Joplin District

EDMUND LYON—Advantage of the temporary shutdown was taken by this mine to equip the mill with motors, two being installed.

CLIFFORD ORE CONCENTRATING CO.—This company, of Ottumwa, Iowa, is adopting a pneumatic system of concentration to work over the tailings dump of the old Reliance mine in the Duenweg district.

FALLS CITY LEAD & ZINC CO.—This company, which has been operating extensively in the West Joplin sheet ground, has acquired a lease of 40 acres on the Kennedy Bros. land at Belville. Prospecting and development will begin at once. The land has never been extensively developed.

MINOR HEIR-SUNRISE—A shaft, 185 ft. deep, has recently been sunk into ore at this mine. An interesting feature of the sinking was that no pumps were used. Drainage was accomplished by a drill hole in the center of the shaft which drained the water into old workings; a small drift having been driven from the workings to the drill hole.

GOOD SHEPHERD—Open-cut operations are being conducted at this mine, near Webb City, at a depth of 175 ft. The ground has been mined so much that cave-ins have occurred at several places allowing the surface dirt to sink into the deepest drifts. All the dirt is being hoisted and a 7% recovery of blende and galena is reported.

EARLY DAWN MINING CO.—This mine, at Aurora, is ready to resume operations after six weeks of repair work. The mill has been rebuilt and equipped to treat 350 tons per 24 hr. Two bodies of silicate ore have been opened; one 30 ft. high and 200 ft. long, the other 25 ft. high and about 250 ft. long. The pumping capacity has been increased to 1200 gal. per min. and new cars and tracks have been added.

ST. LOUIS-JOPLIN LEAD & ZINC CO.—Rich ore has been encountered in the southwestern portion of this company's land west of Joplin, as a result of recent drilling operations. Three drill holes penetrated the orebody which extends from 170 to 206 ft.; a fourth hole has broken into the ore. The property is in virgin ground, half a mile west of the Jackson group. The ore occurs in a soft blue and white chert in ground which requires no timbering.

MONTANA

Butte District

EAST BUTTE—A 150-hp. General Electric motor and control apparatus will be added to the equipment of this mine.

TUOLUMNE—An average of about 250 tons of ore is being mined and shipped daily to the Washoe smeltery from this property. The ore, which averages nearly 7% copper, is being taken principally from the 2000-ft. level. The shaft has been sunk considerably below the 2000-ft. level, and it is the intention of the management to continue without interruption to the 2800- or 3000-ft. level.

ANACONDA—Miners were paid $3.75 per day for February labor, a reduction of 25c. because of the decline in the price of copper. Under the labor agreement adopted last year,

the price of copper was to govern the wage scale. According to this scale, the company should have paid the men $3.50, but, as was done in January, the men were paid 25c. per day more than is called for by the terms of that agreement.

Broadwater County

MAY DAY—Preparations are being made by this company, controlled by St. Paul men, to actively develop the property in the Radersburg district. The shaft is 200 ft. deep, and in crosscutting on this level some time ago, a good body of ore was opened. The company has ordered a new electric hoist and equipment, preparatory to sinking to the 400- or 500-ft. level.

Chouteau County

KING & QUEEN—This property is producing 40 to 50 tons of copper ore daily, which is being shipped to Salt Lake City smelteries. A 100-ton concentrator is being built, and in the last year 1200 ft. of a tunnel has been driven, which, it is expected, will cut the vein 460 ft. below the present lowest working level. C. B. McKennon is manager.

Deer Lodge County

CABLE—W. B. Todd, of Anaconda, has secured a lease on this property in the Georgetown district from H. C. and F. W. Bacorn, the owners, and has placed a crew of four men to work preparing it for operation. The mine has produced between $3,000,000 and $4,000,000, principally in gold, some of the ore being of uncommon richness. The mine has not been operated for several years, and Mr. Todd will clean up and retimber the tunnel, after which development work will be commenced.

Jefferson County

SUNLIGHT—Eastern men have taken a bond on this property and have started work. If the property comes up to expectations extensive improvements will be made in the equipment preparatory to systematic mining.

MAYFLOWER—This property, near Renova, which was closed some time ago because of bad weather, will be opened this spring with an increased force of men. The mine has been a good producer, a large number of cars of ore having been shipped to Butte and East Helena for treatment.

Lewis & Clark County

BALD BUTTE—Owing to the difficulty on account of the heavy snows, in obtaining fuel for the mill at this property, It has only been worked intermittently during the last winter. Work will soon be started again, however, and in the meantime a large tonnage of ore has been mined in readiness for treatment when the mill starts again.

DRUMLUMMON—The new cyaniding plant being built at this property in the Marysville district is rapidly nearing completion, and will probably be ready for operation the latter part of April. A crew has been working in the mine for some time, and a considerable amount of ore is in the bins ready for treatment when the mill is completed.

NEVADA

Comstock Lode

THE PRODUCTION OF THE COMSTOCK MINES for the fourth quarter of 1912 was $265,000.

YELLOW JACKET—The Yellow Jacket mill has been shut down pending repairs to the rock crusher.

OPHIR—Ore shipments have been resumed to the Kinkead mill, and $50 ore is being stoped below the 2500-ft. level.

SIERRA NEVADA—The north drift on the 2500-ft. level shows that the vein is widening, and more low-grade quartz is reported.

MEXICAN—The new tramway between the mill and the Monte Cristo mine has been completed and shipment of ore has been begun.

CROWN POINT—Good progress is being made in reopening the drainage drift on the 1400-ft. level, connecting with the Sutro tunnel, and it will be utilized in the new planned pumping operations.

COMSTOCK-PHOENIX—The material has been ordered for the new tramway to connect the mine with the new mill to be erected upon the old Fischer millsite. It is expected that mill and tramway will be in operation in two months.

CONSOLIDATED VIRGINIA—A report has just been issued by the directors covering development of the upper levels over the Bonanza stopes, now under way. The report was made by Superintendent McCormick and C. E. Julihn, consulting engineer.

Clark County

SANTA CLARA—Mays & Cornellson recently sold their lease on this property to Bourgois & Schmidt, and development work is progressing rapidly. The property adjoins the Bullion.

SEVERAL PROPERTIES HAVE BEEN BONDED by Frank A. Keith and associates, of Los Angeles, including the Anchor Paymaster, Addison and Milford, Hoosier and Mobile groups. A force of men has been put to work on each of the groups, which are scattered through the district, and an active campaign of development will be undertaken. All of the properties have promising prospects. R. W. Moore is in general charge of the work.

YELLOW PINE—A new shoot of mixed lead- and zinc-carbonate ore has been encountered on the second level north of the main shaft, it being a continuation of the main ore-shoot, which has been displaced by a fault, the throw of which was 100 ft. toward the footwall. The ore averages 15 ft. in width, and drifting has progressed a distance of 50 ft. along the strike. A raise is also being driven in the ore and a crosscut through limestone on the third level to tap the vein. The ore in the newly found deposit is high grade, assaying 18% lead, 33% zinc and 14 oz. silver. During February, 1500 tons of zinc concentrate and 350 tons of lead concentrate were shipped, the mill being operated throughout the entire month despite the inclement weather.

Eureka County

GOOD HOPE MINES CO.—This company operating in the Mount Hope district, 30 miles north of Eureka, is developing lead-zinc ore of good grade. W. B. Gillingham is superintendent.

Nye County

BIG FOUR—This mill, at Manhattan, is ready for operation, except for the installation of two large motors.

BONNIE CLARE—About 2600 tons of Jumbo Extension ore is now being treated in this mill, where 15 stamps are dropping.

SHIPMENTS in tons from Tonopah mines for the week ended Mar. 1.

Tonopah Mining	3,300	North Star	....
Tonopah Belmont	3,789	Mizpah Extension	....
Montana-Tonopah	1,038	Jim Butler	450
Tonopah Extension	1,110	Tonopah Merger	225
West End	1,055		
Midway	150	Total	11,677
MacNamara	560	Estimated value	$245,802

NORTH CAROLINA

Stanly County

SOUTHERN ALUMINUM CO.—A contract was awarded recently to H. B. Hardaway & Co., of Atlanta, Ga., to erect a large concrete dam across the Yadkin River, near Whitney.

OREGON

Baker County

COLUMBIA—This mine continues to produce about $25,000 per month; Frank S. Baillie, manager.

UNION COMPANION MINING CO.—This company has recently bought a mine at Cornucopia and has already shipped gold bars from a mill cleanup.

Josephine County

PACIFIC-INTERIOR R.R.—Funds are now provided to pay for the operation and building of this road for 15 miles west and south from Grant's Pass.

ALMEDA CONSOLIDATED MINING CO.—The roads to the mine are still in bad condition, and no effort is being made to haul in the new concentrating tables.

SWASTIKA—This hydraulic placer, owned by Cook & Howland, is running night and day and several giants are at work. New pipe and several giants have recently been installed.

ORIOLE—The 10-stamp mill and other machinery which has been ordered for this mine will soon be on the ground. Much development work is now being done. Manager J. C. Mattison states that no more ore will be shipped to the smelter, but that it will be kept in the bins till the mill is in operation.

Jackson County

WORK ON THE INTERURBAN ELECTRIC LINE between Medford and Ashland, has been begun. The road will enable many mines that are not now operated on account of lack of transportation, to begin production. The line will go through the property of the Sterling placer mines, which was recently purchased by S. S. Bullis & Son, of New York.

Malheur County

A POWER LINE HAS RECENTLY BEEN COMPLETED from Gypsum, on the Snake River, to the Mormon Basin, and supplies power to the Rainbow and Humboldt mines. This power being available has been the cause of increased activity in this district.

SOUTH DAKOTA

Lawrence County

RESCUE CAR NO. 5, of the U. S. Bureau of Mines, recently left the Black Hills after a two-weeks' stay, during which a number of crews were instructed in mine rescue, first-aid work, etc. The car is in charge of O. U. Bradley. One week was spent at the Homestake and one week at the Trojan. This is the second visit of a safety car to this district, the first having been in September, 1911.

WASP NO. 2—Work was suspended, Feb. 28, at the order of the board of directors, who decided that work was handicapped by the cold weather. All mining is done in open cuts, and the ore reached the mill frozen and mixed with ice and snow, giving trouble in the crushing and leaching departments. A few men will be kept at work on repairs and improvements, and operations at the mine and mill will probably be resumed about Apr. 1. During the last two or three months profits have fallen below the normal. In January they were only $5500; last year they exceeded $115,000.

FEBRUARY WAS A MONTH OF SEVERE WEATHER in the Black Hills. According to the records there were 13 days when the thermometer registered below zero. The coldest day was Feb. 4, showing 17° below for the minimum and 5° above for the maximum. There were only 10 days when the mercury rose above the freezing point. There was 1 in. of snow, Feb. 1, and 5 in. Feb. 19. During the winter, up to Feb. 28, 61.75 in. of snow had fallen, of which 7 in. remained on the ground on that date. Since Mar. 2 the weather has improved and a thaw has started, with every indication that the extremely cold weather is at an end.

TEXAS

A BILL FOR A LEASING SYSTEM, through which all the mineral lands owned by the state of Texas may be developed by the mining operators paying a royalty of 5% of the gross receipts from the sale of the output of each mine into the treasury of the state, has been introduced in the legislature. The state owns 1,750,000 acres of land, a large part of which is supposed to contain mineral. The present law gives the prospector little incentive. The lands in question have little value for agricultural purposes.

UTAH

Beaver County

SHEEP ROCK—Several sections of the stamp mill recently started are in operation. Ore is being mined in several places.

MOSCOW—It is reported that after the payment of the expected March dividend that monthly dividends of 1c. per share will be replaced by quarterly dividends of equivalent amount.

BEAVER GOLD—Development work will be continued from the fund of $2000 recently raised by the sale of treasury stock. There is a streak of ore in the bottom of the 100-ft. shaft, and this will be followed to greater depth.

Juab County

VICTORIA—Drifting is being done on the 1200 to prospect new ground south of the shaft.

UTAH—Two cars of ore from this mine, at Fish Springs, were marketed in February, bringing $5300.

IRON BLOSSOM—February shipments were 85 cars. During the month the shaft was partially retimbered at the 800 level.

TINTIC SHIPMENTS FOR THE WEEK ENDED MAR. 1, held down by heavy snows, amounted to 128 cars. Shipments for the four weeks of February were 700 cars, showing a decrease of 175 cars from those of the five weeks included in January. Bad weather impeded shipments. The Mammoth, Dragon Consolidated, Beck Tunnel, Uncle Sam and Victor lease showed a gain over the month preceding.

Salt Lake County

MICHIGAN-UTAH—A shipment of 100 tons of ore has been made recently.

ALTA CONSOLIDATED—The winze is down about 60 ft., and sulphide ore is in the bottom, carrying copper, silver and lead.

NEW UTAH-BINGHAM—The Utah-Bingham Co., recently reorganized under the forementioned name, has resumed work with a force of 22 men. The property adjoins the Telegraph.

WASATCH MINES—The merger under this name of the Columbus Consolidated and Superior Alta with the Flagstaff, was ratified, Feb. 28, by the stockholders of the first two companies. The stockholders of the Flagstaff had already agreed to the consolidation. The new company is capitalized at 1,000,000 shares, of which 160,000 go to the Columbus Consolidated, 100,000 to the Flagstaff, and 40,000 to the Superior Alta, with 700,000 shares remaining in the treasury.

Summit County

PARK CITY SHIPMENTS for the week ended Mar. 1, were 2,891,450 lb.

DALY WEST—Work was suspended for a few days owing to an accident to one of the engines.

ONTARIO SILVER—A strike is reported in a drift from the Ontario drainage tunnel on the 1500-ft. level. It is reported that the company may again begin operations on its own account.

Utah County

GARFIELD SMELTING CO.—At the smeltery at Garfield, two oil storage tanks of 40,000 gal. capacity are being erected. Four of the six reverberatory furnaces are using oil and ultimately fuel oil will be used throughout the plant where possible.

PACIFIC GOLD—A statement recently issued to stockholders shows that this property in American Fork Cañon marketed 416,982 lb. of ore, valued at $8139, during the last year. The second-class dump was leased and lead concentrates were made by the lessees by jigging.

WASHINGTON

Chelan County

WENATCHEE GOLD MINING CO.—A stamp mill has been ordered for the Rex mine in the Entiat Valley. The tunnel is now in 115 ft., and rich ore was recently encountered. This company has paid dividends for the last two years.

Stevens County

HIGH GRADE—The first shipment of ore from this silver and copper property in the Chewelah district, is being loaded for the smelter.

FAIRVIEW—A 5-ft. vein of copper and silver ore has been uncovered in the 300-ft. tunnel on this property near Chewelah. This is one of the richest strikes made at this mine.

Snohomish County

FORTY FIVE—Most of the buildings at this mine, near Sultan, were recently destroyed by a snowslide. New buildings will be erected at once.

CANADA

British Columbia

RICHMOND CONSOLIDATED CO.—Extensive development is planned for this property near Rossland; Joseph L. Warner, manager.

PHOENIX GOLD MINING CO.—Returns at the rate of $65 per ton, in gold and copper, have been received by J. W. Witherop, president of this Rossland company.

WATERLOO & FONTENOY GROUP—This group of claims at Camp McKinley, has been bonded for $50,000 by J. W. Osborne and associates. The Waterloo yielded $40,000 to Dennis Clark, a former owner.

GREEN MOUNTAIN GROUP—A mineralized zone 150 ft. wide, carrying gold and silver ore throughout much of that width, has been opened by C. B. Clark, of Spokane, owner of this property near Hazleton. The assays range from $8 to $125 per ton.

FLORENCE SILVER MINING CO.—An important strike was made a few weeks ago at the surface of this company's property in the Ainsworth district. The ore has been crosscut for 18 ft., but the wall has not been reached. Two-thirds of the ore is solid, the rest of a high-class milling grade; 300 tons of ore has been broken, much of which has been sacked and part of it shipped. Returns on the first car load from Trail show a content of 20 oz. of silver per ton and 40% lead. The net profit is $25 per ton. Ferdinand R. Wolfle is president.

Ontario Cobalt

TRETHEWEY—Negotiations are in progress for the sale of this property to an English syndicate for $750,000.

LA ROSE—Production for January was 219,977 oz., valued at $134,724. The net profits were $76,278; cash in bank and ore on hand amounts to $1,548,268.

SILVER PRINCE—A. A. Amos is reopening this property which has been idle since 1906 when a small amount of development work was done by the MacKenzie & Mann interests.

COBALT LAKE—At the annual meeting, Sir Henry Pellatt announced that 90% of the stock in the company had been deposited, according to the agreement made with the English syndicate which has purchased the mine.

PENN-CANADIAN—A 5-in. vein of good ore has been encountered on the 150-ft. level. New ore has been found on the fifth level, where milling ore has been developed. The old shoot of milling ore on the fourth level is being worked with good results.

CITY OF COBALT—The shareholders have ratified the sale of this company to an English syndicate for $750,000. This is at the rate of 52½% per share of capital stock. The first payment falls due in 30 days and is for $375,000 and the balance in 60 days.

BEAVER—Crosscutting for the main vein on the 700-ft. level is in progress. This is the deepest shaft in Cobalt and developments are being watched with interest. By the installation of one ball mill, two pebble mills and six more tables, the capacity of the mill has been increased to 100 tons daily.

SHIPMENTS of ore and concentrates, in tons, from Cobalt mines for the week ended Feb. 28, were as follows:

Bailey	.....	Kerr Lake	.....
Beaver	21.81	La Rose	115.34
Buffalo	.....	Lost and Found	.....
Casey Cobalt	.....	McKinley-Darragh	96.73
Chambers-Ferland	32.06	Nipissing	40.62
City of Cobalt	.....	Nipissing Reduction	30.00
Cobalt Lake	31.85	O'Brien	31.07
Cobalt Townsite	.....	Penn.-Canadian	.....
Colonial	21.56	Provincial	.....
Coniagas	.....	Right of Way	.....
Crown Reserve	.....	Seneca Superior	.....
Dominion Reduction Co.	43.70	Silver Queen	.....
Drummond	.....	Timiskaming	45.12
General Mines	.....	Trethewey	.....
Green Meehan	.....	Wettlaufer	.....
Hargraves	.....		
Hudson Bay	32.60	Total	480.40

Ontario-Porcupine

GRIERSON—Operations have been resumed.

THE 1912 GOLD OUTPUT from Porcupine was $1,750,000.

ORR—Operations have been started on these claims which were purchased recently by Doctor Wettlauffer, of Buffalo.

WISHMAN—These claims, which adjoin the Foster-Tough properties on the west, are said to be sold to Toronto men for $100,000.

HUGHES-RAMSBOTTOM—The Great Northern Silver Mines are said to have purchased a controlling interest in these claims.

JUPITER—As soon as the mine is unwatered, the company will start sinking the main shaft to the 500-ft. level. A new compressor and other machinery has been ordered and a 10-stamp mill will be built in the spring.

HOLLINGER—The net operating profit from July 1 to Dec. 31, 1912 was $600,664, notwithstanding the heavy additional expenses and losses during November and December on account of the strike. The company now has 40 stamps in operation. For the two weeks ended Feb. 4 and 11, there was milled 2025 and 2122 tons containing $65,005 and $59,313 respectively. Drifting on the 300-ft. level has shown better ore than that last reported; 490 men are employed.

MEXICO

Chihuahua

AMERICAN SMELTING & REFINING CO.—A fairly large shipment of coal and coke has been received at the smeltery from El Paso, and 11 carloads of base bullion were recently shipped.

SOUTH AMERICA

Venezuela

CANADIAN-VENEZUELA ORE CO.—This company, of which F. P. Jones is president, and Sir William Van Horne is vice-president, has a contract to deliver 100,000 tons of iron ore per year, but is now experiencing difficulty in securing transportation for its ore. Only one steamer is now employed in carrying supplies to the mines and ore to Philadelphia. It is expected that the transportation problem will be solved within the next year and the shipments gradually increased up to a possible maximum of 80,000 to 100,000 tons per month.

AUSTRALIA

Tasmania

NORTH MT. LYELL—After a search of four and a half months, 45 bodies have been recovered from this mine, and further search has been abandoned. A fire was started in the mine by an explosion, Oct. 12, and in the present condition of the mine, further exploratory work is stated to be unsafe.

THE MARKET REPORT

METAL MARKETS

NEW YORK—Mar. 12

The metal markets are still rather unsettled, in copper especially, but business has been on a fairly good scale. The present tendency is to greater firmness.

MONTHLY INDEX NUMBERS

Month	1912	1913	Month	1912	1913	Month	1912	1913
Jan.	111	126	May	118	...	Sept.	127	...
Feb.	109	125	June	117	...	Oct.	133	...
March	111	...	July	114	...	Nov.	129	...
April	115	...	Aug.	120	...	Dec.	129	...

Average for year 1912, 119; year 1911, 112; year, 1910, 115; year 1909, 115. Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

Gold—The price of gold on the open market in London was unchanged, at 77s. 9d. per oz. for bars, and 76s. 4d. per oz. for American coin. There was a strong demand from Germany, but no premium was paid. In New York there were heavy exports, $2,000,000 going to Paris, and $2,700,000 to Belgium and Germany, and $4,435,000 to Argentina, the latter on English account.

Exports from the port of New York, week ended Mar. 8, included $2,625,217 gold, chiefly to Argentina, and $1,271,278 silver, principally to London. Imports included $591,345 gold and $178,985 silver, mostly from Mexico and South America.

Sales of gold bars from the New York assay office were $2,591,241 in February. For the two months ended Feb. 28, they were $5,479,803, an increase of $673,739 over last year. New sales are chiefly to jewelers and others for use in the arts.

Gold in the United States, Mar. 1, is estimated by the Treasury Department as follows: Held against gold certificates outstanding, $1,082,198,169; in Treasury current balances, $174,664,788; in banks and circulation, $610,357,741; total, $1,867,220,698. This shows a decrease of $8,405,420 during February.

Gold and Silver Movement in France year ended Dec. 31:

	Gold		Silver	
	1911	1912	1911	1912
Imports	Fr. 264,563,000	Fr. 253,477,000	Fr. 197,741,000	Fr. 274,858,000
Exports	139,446,000	35,500,000	144,532,000	282,677,000
Excess	I.Fr.125,117,000	I.Fr.217,977,000	I.Fr.53,209,000	E. Fr.7,819,000

France accumulated gold largely in 1912. Nearly half the imports were in bullion, but four-fifths of the exports were in coin.

Silver has again experienced a sharp fall, today touching 26 9/16 d. in London, the lowest point reached on the reaction. Pressure to sell is attributed to operations on China account—an erratic and uncertain factor.

Coined silver in the United States, Mar. 1, is estimated by the Treasury Department as follows: Standard dollars, $565,536,020—of which $469,324,000 are held against silver certificates outstanding; subsidiary coins, $174,897,996; making $740,434,016 in all.

Iridium—Supplies are still short, and it is difficult to fill orders. The price ranges about $85 per oz. for what metal can be had.

Platinum—The market is steady and unchanged. Prices appear to be pegged, and talk of a fall is no longer heard. Dealers here ask $45@46 per oz. for refined platinum and $49@53 per oz. for hard metal. The foreign market is unchanged.

Our Russian correspondent writes, under date of Feb. 27, that offers to buy large lots at lower prices have been made, but not accepted by holders. There is a good demand for smaller lots. Actual transactions have been small, but the market is firm at unchanged prices—9.70 rubles per zolotnik at Ekaterinburg and 37,700 rubles per pood at St. Petersburg for crude metal, 83% platinum. These prices are equal to $36.47 and $36.95 per oz. The stocks in St. Petersburg are rather light.

Copper, Tin, Lead and Zinc

Copper—A rather large business, amounting in the aggregate to many millions of pounds, was done on Mar. 6-8, both with European and American buyers, the sales to the latter predominating. The unsettled situation in Europe in general, and more particularly in Germany, has reduced the demand from abroad. Business on Mar. 6 was taken at only a slight advance over the last previous quotation, but on the following day 15c., less 0.5% commission and the freight, was realized from domestic consumers, while exports to Europe were made at 15c., less costs, insurance and freight. After the publication of the February refinery statistics opinions among the selling agencies became divergent. In some quarters the price asked was raised to 15⅛c., in other quarters the previous price of 15c. was maintained, and in other quarters some tendency to place copper, even if concessions had to be made, was manifested. On Mar. 10 a fair amount of business with domestic consumers was done at 14.95@15c., usual terms, corresponding to about 14.80@14.85c., cash, New York, and a round lot, 1,000,000 lb., was sold at 14.77½c., cash.

DAILY PRICES OF METALS

NEW YORK

Mar.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
6	4.8785	59⅜	14.80 @15.00	14.75 @14.80	47¾	4.32½ @4.35	4.17½ @4.20	6.20 @6.30	6.05 @6.15
7	4.8785	58⅝	14.80 @15.00	14.75 @14.85	47½	4.32½ @4.35	4.17½ @4.20	6.20 @6.30	6.05 @6.15
8	4.8780	58¾	14.90 @15.10	14.75 @14.85	47¼	4.30 @4.35	4.15 @4.20	6.20 @6.30	6.05 @6.15
10	4.8780	58¾	14.90 @15.10	14.75 @14.85	46⅞	4.30 @4.35	4.15 @4.20	6.20 @6.30	6.05 @6.15
11	4.8780	58½	14.90 @15.10	14.75 @14.85	46½	4.30 @4.35	4.15 @4.20	6.20 @6.30	6.05 @6.15
12	4.8780	57⅞	14.90 @15.10	14.75 @14.85	46¼	4.30 @4.35	4.15 @4.20	6.20 @6.30	6.05 @6.15

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. belo w that of electrolytic. The quotations for lead represent wholesale transactionsin the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

Mar.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
6	27 5/16	66	66¼	70¾	216¾	213¾	15¾	24¾
7	26 13/16	65¼	65½	70¼	215	211½	15½	24½
8	27	....	....	....	....	....	....	....
10	27	65	65¼	70½	212	209	15 7/16	24½
11	26 13/16	65¼	65¾	70½	212	209	15 5/16	24½
12	26¾	64⅞	65½	70½	211½	208¼	15 11/16	24½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb, except silver which is in pence pertroy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, pot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; = £25 = 5.44c.; £70 = 15 22c. Variations, £1 = 21¾c

New York. On Mar. 11 and 12 business dwindled materially in volume, and there was a weaker tone, without there being any quotational change.

A fair business in Lake copper is reported at around 14⅞c., net cash, on Mar. 6 and 7, and around 15c. during the remainder of the week. The Calumet & Hecla is understood to have raised its price to 15¼c., usual terms, during the week, and to have made considerable sales. Special brands of Lake Copper realized as high as 15.10c. during the week. The close is steady at 14.90@15.10c. for Lake copper, and 14.75@14.85c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 14.60@14.70c. as an average for the week.

The standard market reflected the uneasiness prevailing abroad, and prices gradually receded, the close being cabled as easy at £64 17s. 6d. for spot, and £65 10s. for three months.

Base price of copper sheets is 21@22c. per lb. Full extras are charged, and higher prices for small quantities. Copper wire is 16@16½c. base price, carload lots at mill.

Copper exports from New York for the week were 9471 long tons. Our special correspondent gives the exports from Baltimore at 3222 tons for the week. Total exports for the two months ended Feb. 28 are estimated at 51,800 tons.

Tin—The market was depressed during the entire period under review, and developed a decided weakness, especially at the beginning of this week. A great amount of liquidation, due to the strained financial condition in Germany, took place, and sales on the London Metal Exchange took on huge proportions. In this market buyers were rather reticent and were not tempted by offers made at below the parity of London prices. At the close the markets both here and abroad are somewhat steadier, and are quoted at £211 10s. for spot, and £208 5s. for three months, and about 46.25c. for March delivery.

Lead—The market has displayed rather a weaker tone. On Mar. 8, a considerable tonnage was placed at 4.17½c., St. Louis, which has remained about the average since then. On the whole this market has been rather quiet throughout the week and offerings have been on a more liberal scale. The market closes barely steady at 4.15@4.20c. St. Louis, and 4.30@4.35c. New York.

The London market has moved erratically, there being slight fluctuations from day to day, which are without special significance.

The close is steady at £15 13s. 9d. for Spanish lead, and 7s. 6d. higher for English.

Spelter—There has been something of a change of sentiment in this market, which a week ago looked very strong. Since then some producers who previously had been standing aloof have altered their policy and have offered spelter liberally. Spot spelter has been bid up on relatively trifling business in order to facilitate the placing of heavy tonnages under contract, in which several interests have been active, without letting much be known about their operations. A large tonnage is reported sold for April, for April-May, and for April-May-June delivery, at prices averaging about 6.05@6.10c., St. Louis. There has been only a slight demand for prompt delivery. It appears that consumers have been more inclined to take hold of spelter at the present level of prices, wherefore their buying for future delivery. The market closes firm at 6.05@6.15c. St. Louis, and 6.20@6.30c. New York.

There has been a further decline in the London market, which, however, has so far not increased business. The close is cabled at £24 10s. for good ordinaries, and £24 17s. 6d. for specials.

Base price of zinc sheets is $8.25 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

The Edgar Zinc Co. has purchased all saleable reserve stock suitable for its use in the Joplin district, and from each purchaser has contracted one to two weeks' future production. None of this ore has yet been shipped. The closed down mines in the district resumed operations Mar. 10.

The American Metal Co. has taken over the Altoona works of the Kansas Zinc Co.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

	Nov.	Dec.	Jan.	Feb.
Alaska shipments	1,671,367	3,766,029	1,668,328	660,250
Anaconda	24,250,000	23,400,000	21,000,000	21,250,000
Arizona, Ltd	3,000,000	3,100,000	3,100,000	3,000,000
Copper Queen	8,807,940	8,805,568	7,554,966	6,810,706
Calumet & Arizona	4,918,000	5,840,000	4,750,000	.....
Chino	3,911,169	3,368,850	2,903,030	3,813,998
Detroit	1,968,620	2,389,875	1,769,071	1,689,277
East Butte	1,245,504	1,314,021	1,469,000	.....
Mammoth	1,805,869	1,850,000	.....	.....
Giroux	*nil*	625,000	.....	.....
Mason Valley	1,500,000	1,550,000	1,575,100	.....
Nevada Con.	4,160,533	3,975,631	4,169,705	.....
Ohio	573,644	566,816	.....	.....
Old Dominion	2,758,000	2,727,000	2,727,000	2,381,000
Ray	3,191,026	3,638,500	3,610,000	3,610,000
Shannon	1,435,709	1,361,420	1,232,000	1,152,000
South Utah	*nil*	*nil*	.....	.....
United Verde*	2,900,000	3,000,000	.....	.....
Utah Copper Co	4,562,417	5,676,484	7,182,495	.....
Lake Superior*	20,400,000	18,300,000	17,500,000	.....
Non-rep. mines*	8,250,000	7,750,000	7,500,000	.....
Total production	97,310,698	102,805,194	.....	.....
Imports, bars, etc	22,797,099	28,761,087	.....	.....
Total blister	120,107,797	131,566,281	.....	.....
Imp. in ore and matte	8,149,728	10,385,662	.....	.....
Total American	128,248,525	141,951,943	.....	.....
Miami†	2,972,000	2,913,840	2,932,369	2,817,200
Brit. Col. Cos.:				
British Col. Copper	881,582	.....	.....	.....
Granby	1,852,896	.....	1,792,245	1,740,000
Mexican Cos.:				
Boleo†	2,315,040	2,480,240	2,658,880	2,535,680
Cananea	5,064,000	5,592,000	.....	4,880,000
Moctezuma	2,112,377	2,793,781	2,913,294	2,730,914
Other Foreign:				
Braden, Chile	1,028,000	910,000	1,484,000	1,178,000
Cape Cop., S. Africa	907,200	750,560	770,540	.....
Kyshtim, Russia	1,523,200	1,489,600	1,644,160	.....
Spassky, Russia	974,400	974,400	974,400	.....
Exports from				
Chile	4,816,000	7,392,000	6,752,000	.....
Australia	10,752,000	9,856,000	9,744,000	.....
Arrivals in Europe‡	12,976,320	16,363,200	17,689,280	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
II, 1912	116,035,809	56,228,368	63,148,096	66,280,643	154,851,200	221,131,843
III	125,694,601	67,487,466	58,779,566	62,939,988	141,142,400	204,082,387
IV	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186,757
V	126,737,836	72,702,277	69,485,945	65,066,029	134,176,000	199,242,029
VI	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	.....	.....	.....	122,302,890	81,244,800	203,547,690

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Other Metals

Aluminum—The market has been active, and sales good, better than for some weeks past. Metal for early delivery is in demand. Prices are firmer, 26½@27c. being asked for No. 1 ingots, New York. The foreign market is strong.

Antimony—Business is still quiet and prices unchanged. Cookson's is quoted at 9¼@9½c. per lb., and Hallett's at 8⅞@9½c.; while 8⅛@8⅜c. is named for Chinese, Hungarian and other outside brands. Prices here are below the parity of the foreign markets. The tone is improved, however, and an advance may be expected.

Quicksilver—The market is quiet, with business on a moderate scale. The New York quotation is still $40 per flask of 75 lb., with 59@60c. per lb. asked for retail lots. San Francisco, $40 per flask for domestic orders and $37.50 for export. London price has been reduced 5s., to £7 10s. per flask, with £7 5s. quoted by second hands.

Nickel—Shot, blocks and plaquettes bring 40@45c. per lb., according to quality. Electrolytic nickel is 3c. per lb. higher.

Zinc and Lead Ore Markets

JOPLIN, MO., MARCH 8

The high price of zinc sulphide ore is $53, an advance of $2, the base $46@50 per ton of 60% zinc. Calamine sold at $24@27 per ton of 40% zinc. The average of all grades is $45.14. The high price of lead is $56, on a base of $53.50 per ton of 80% metal contents. The average of all grades is $53.08 per ton.

SHIPMENTS, WEEK ENDED MARCH 8

	Blende	Calamine	Lead Ore	Value
Totals for week...	8,147,000	714,180	1,637,310	$242,907
Ten weeks 101,881,520		6,419,020	18,744,220	$3,123,592

Blende value, the week, $189,255; 10 weeks, $2,532,659.
Calamine value, the week, $10,185; 10 weeks, $96,802.
Lead value, the week, $43,467; 10 weeks, $494,131.

PLATTEVILLE, WIS.—Mar. 8

The highest premium price paid this week for zinc ore was $50; the base price, 60% zinc, was $45@49 per ton. The base price paid for 80% lead ore was $52@53 per ton.

SHIPMENTS WEEK ENDED MAR. 8

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	3,312,510	61,200	1,014,950
Year to date	31,981,350	1,237,630	10,870,390

Shipped during week to separating plants, 2,314,100 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—Mar. 12

The iron and steel markets show little change in degree of activity or in prices.

The demand for structural steel continues the strong feature of the market. Small material—bars and sheets especially—is in heavy demand. Bars for early delivery command a premium.

Pig iron is more steady, a good deal of the resale and speculative iron having been worked off. There is more demand for foundry iron, chiefly in small lots.

The Bethlehem Steel Co. will resume dividends on the preferred stock, paying 5%, the first since 1907. The surplus has been put into extensions.

The Steel Corporation reports unfilled orders on Feb. 28, at 7,656,704 tons. This is a decrease of 170,054 tons from Jan. 31, but an increase of 2,202,504 tons over Feb. 28 last year.

Pig-iron Production—The reports of the furnaces, as collected and published by the "Iron Age," show that on Mar. 1, there were 303 coke and anthracite stacks in blast, having a total daily capacity of 93,100 tons of pig iron daily; an increase of 1800 tons over Feb. 1. Making allowance for the charcoal furnaces, the estimated make of pig iron in February was 2,621,300 tons; for the two months ended Feb. 28, it was 5,451,600 tons. Of this total 3,773,700 tons, or 69.2%, were made by the furnaces owned or operated by steel companies.

Foreign Iron Trade of Germany year ended Dec. 31, 1912, in metric tons:

	Exports	Imports	Excess
Pig iron	1,015,957	135,722	Exp. 880,235
Other iron and steel	5,004,945	538,188	Exp. 4,466,757
Machinery	536,681	77,939	Exp. 458,742
Total	6,557,583	751,849	Exp. 5,805,734
Total, 1911	5,857,184	678,581	Exp. 5,178,601

There was in 1912 an increase of 700,399 tons, or 12%, in exports, and an increase of 73,268 tons, or 10.8% in imports.

PITTSBURGH—March 11

There has been an increase in specifications for finished steel products in the past week. Steel manufacturers are encouraged by this, although recognizing that the change may be only temporary. However, it is a fact that in the steel industry as a whole the specifications received since Jan. 1 have exceeded the shipments. The total volume of obligations has decreased, as new contracting has been light. The independent steel companies have been following the Steel Corporation's monthly reports closely, and generally find that their own experience tallies closely with that of the corporation. It is estimated that shipments during the two months were practically at capacity, which means that new bookings fell short of shipments by 10 to 20%. The decrease in total obligations is slight, and the conversion of contract obligations into specifications is regarded as the more important. The present situation is distinctly better than 60 days ago.

The bi-monthly settlement of iron mill wages under the Amalgamated Association scale made this morning, showed that the average price realized on base sizes of iron bars shipped from the six selected mills during January and February was 1.4831c., making the settlement for March and April wages on the basis of 1.45c., against 1.40c. for the preceding period, and giving the puddlers an advance from $6.45 to $6.60 a ton.

Pig Iron—The predicted buying movement in bessemer and basic iron is apparently no nearer, but the market has not declined. In foundry iron there has been a further decline of 25c. We quote: Bessemer, $17.25; basic, $16.25; No. 2 foundry, $16.75; forge, $16.25@16.50; malleable, $17, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market continues dull and only fairly firm, with prompt lots occasionally offered under the contract price, which is $65, Baltimore.

Steel—The market has been practically bare of offerings and can still be quoted at $29 for billets and $30 for sheet bars and rods, at maker's mill, Pittsburgh or Youngstown.

Sheets—Buying of sheets for far forward delivery has been fairly heavy. Specifications against contracts have distinctly improved, and again exceed current shipments. The leading interests are sold practically full to July 1, with the actual specifications on books, and the bulk of second-half capacity under contract. We quote: Black sheets, 28 gage, 2.35c.; galvanized, 28 gage, 3.50c.; blue annealed, 10 gage, 1.75c.; painted corrugated, 28 gage, 2.55c.; galvanized corrugated, 28 gage, 3.55c., per pound.

IRON ORE

Imports of iron ore in Austria Hungary year 1912 were 682,012 tons; exports, 148,276 tons. Imports of manganese ore were 62,082 tons; exports, 534 tons.

COAL TRADE REVIEW

NEW YORK—March 12

Spring conditions begin to prevail in the bituminous trade. In the West the demand for steam coal is large and steady. There is some complaint of car shortage. The demand for gas coal from the Pittsburgh district and West Virginia is large, owing to the high price of crude oil. Anthracite trade is slow, orders being held back for the April discounts.

Anthracite Shipments in February were 5,674,169 tons, or 201,790 tons less than in February, 1912. For the two months ended Feb. 28, the shipments were 11,639,664 long tons in 1912, and 12,010,588 in 1913: an increase of 370,924 tons, or 3.2%. Stocks on hand at tidewater, Feb. 28, are reported at 484,270 tons, an increase of 108,704 tons during February.

Foreign Coal Trade of the United States for the year ended Dec. 31, is reported as below, in long tons:

	Exports		Imports	
	1911	1912	1911	1912
Anthracite	3,533,999	3,688,789	3,159	1,670
Bituminous	13,878,754	14,459,978	1,238,808	1,608,350
Coke	914,042	814,800	60,515	110,347
Steamer coal	6,668,338	7,340,100	.....	.....
Total	25,014,133	26,303,667	1,301,482	1,720,367

The steamer coal, furnished to steamships in foreign trade, is practically all bituminous. The exports are largely to Canada; the imports are chiefly on the Pacific Coast and are also chiefly from Canada.

CHEMICALS

NEW YORK—Mar. 12

The general chemical trade continues steady and good in most lines.

Arsenic—Trade is dull and demand is not up to supply. Prices are $4@4.25 per 100 lb. and inclined to weakness.

Copper Sulphate—Trade is quite active. Prices are unchanged at $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The spring trade is fair and there has been some good buying by the fertilizer makers. Quotations are strong at 2.62½c. per lb. for spot and April; 2.60c. for May; 2.57½c. for June; 2.55c. for July; 2.52½c. for August and later deliveries.

Assessments

Company	Delinq	Sale	Amt.
Advance, Ida	Mar. 15	Apr. 15	$0.003
Alta, Nev	Mar. 24	Apr. 14	0.05
Bell, Ida	Mar. 12	Apr. 12	0.01
Blue Star, Wash	Mar. 7	.....	0.001
Black Horse, Ida	Mar. 8	Mar. 27	0.005
Challenge, Nev	Apr. 1	Apr. 22	0.05
Chollar, Nev	Mar. 31	Apr. 24	0.03
Coeur d'Alene Vulcan, Ida	Mar. 2	Mar. 22	0.005
Corbin Copper, Mont	.....	Apr. 22	0.50
Crown Point, Utah	Mar. 20	Apr. 15	0.01
Gold M'ntain Champ., Utah	Mar. 4	Mar. 22	0.01
Great Falls, Utah	Mar. 22	Apr. 22	0.01
Hypotheek, Ida	Feb. 21	Mar. 14	0.01
National Copper, Ida	.....	.....	0.01
Nicodemus, Ore	Mar. 14	.....	0.05
Overman, Nev	Mar. 18	Apr. 8	0.05
Pacific Quicksilver, Calif	Mar. 5	.....	0.03
Pioche Metals, Nev	Feb. 10	Mar. 17	0.01
Relonia M. & M., Utah	Mar. 6	Apr. 5	0.001
Sierra Nevada, Nev	Apr. 2	Apr. 23	0.10
Tar Baby, Utah	Mar. 10	Apr. 7	0.01
Tintic Central, Utah	Mar. 11	Mar. 29	0.01
Utah, Nev	Feb. 25	Mar. 18	0.05
Wabash, Utah	.....	Apr. 10	0.05

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	55.795	56.260	62.938	24.865	25.887	28 983
February	52.222	59 043	61.642	24.081	27.190	28 357
March	52.745	58.375	.....	24.324	26.875	.....
April	53.325	59.207	.....	24.595	27.284	.....
May	53.308	60 880	.....	24.583	28 038	.....
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63 078	.....	24.209	29 088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29 012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16 767	62.760	71.741
February	14.084	14.971	14.329	15.253	62 893	65.519
March	14.698	.....	14.868	.....	65.884	.....
April	15 741	.....	15.930	.....	70.294	.....
May	16.031	.....	16 245	.....	72.352	.....
June	17 234	.....	17 443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78 670	.....
September	17.508	.....	17.698	.....	78.762	.....
October	17.314	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50 298	191.519	238.273
February	12.962	48.766	195.036	220.150
March	12.577	.....	192.619	.....
April	43.923	.....	200.513	.....
May	16.063	.....	208.830	.....
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3 946	4.175	15 738	16.550
March	4.073	.....	4.046	.....	15.997	.....
April	4.200	.....	4.118	.....	16 331	.....
May	4.194	.....	4 072	.....	16 509	.....
June	4 392	.....	4.321	.....	17 588	.....
July	4 720	.....	4.603	.....	18 544	.....
August	4.569	.....	4.452	.....	19.655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20 630	.....
November	4.615	.....	4.463	.....	18 193	.....
December	4.303	.....	4.152	.....	18.069	.....
Year	4 471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26 661	25.338
March	6.626	.....	6.476	.....	26.048	.....
April	6.633	.....	6.483	.....	25 644	.....
May	6.679	.....	6.529	.....	25.790	.....
June	6.877	.....	6 727	.....	25.763	.....
July	7.116	.....	6 966	.....	26.174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7.313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7 371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26 494	.....
Year	6.943	.....	6.799	.....	26 421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	.....	13.66	.....	14.10	.....
April	15.13	.....	13.90	.....	14.15	.....
May	15.14	.....	13.90	.....	14.12	.....
June	15.15	.....	14.11	.....	14 22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14 90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17 22	.....
November	18.07	.....	17.09	.....	18 00	.....
December	18.15	.....	17.45	.....	18 73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS Mar. 11

Name of Comp.	Bid.
Acacia	.03
Cripple Cr'k Con.	.01
C. K. & N.	.12
Doctor Jack Pot	.05
Elkton Con.	.61
El Paso	5.81
Findlay	.04
Gold Dollar	.11
Gold Sovereign	.02
Isabella	.11
Jack Pot	.05
Jennie Sample	.05
Lexington	‡ 008
Moon Anchor	‡.005
Old Gold	.02
Mary McKinney	.64
Pharmacist	.01
Portland	.99
Vindicator	94
Work	‡.004

SALT LAKE Mar. 11

Name of Comp.	Bid.
Beck Tunnel	.07
Black Jack	10
Cedar Talisman	.005
Colorado Mining	.11
Columbus Con	05
Crown Point	02
Daly-Judge	6.25
Grand Central	74
Iron Blossom	1.47
Little Bell	35
Lower Mammoth	02
Mason Valley	6 00
May Day	14
Nevada Hills	1 20
New York	‡ 005
Prince Con	67
Silver King Coal'n	3.10
Sioux Con	03
Uncle Sam	03
Yankee	12

TORONTO Mar. 11

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.09	Foley O'Brien	.32
Coniagas	7 50	Hollinger	17 00
T. & Hudson Bay	‡69.00	Imperial	.05
Timiskaming	39	Jupiter	.46
Wettlaufer-Lor	12	Pearl Lake	74
Apex	‡.02	Porcu. Gold	27
Crown Chartered	01	Preston E. D	‡.03
Dobie	‡ 25	Rea	.30
Dome	17 50	Swastika	.16
Dome Exten	.13	West Dome	‡.18

SAN FRANCISCO Mar. 11

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.02	Belmont	7.25
Belcher	.30	Jim Butler	.73
Best & Belcher	.05	MacNamara	.20
Caledonia	2.15	Midway	.49
Challenge Con	.06	Mont.-Tonopah	1.55
Chollar	.01	North Star	.22
Confidence	.40	West End Con	1.32
Con. Virginia	.23	Atlanta	.16
Crown Point	.30	Booth	.04
Gould & Curry	.03	C.O.D. Con	.06
Hale & Norcross	.09	Comb. Frac	.06
Mexican	.76	Jumbo Extension	.28
Occidental	.70	Pitts.-Silver Peak	.55
Ophir	.21	Silver Pick	.04
Overman	.55	St. Ives	.30
Potosi	.04	Tramp Con	.02
Savage	.04	Argonaut	‡2.00
Sierra Nevada	.11	Bunker Hill	‡1.50
Union Con	.12	Central Eureka	.17
Yellow Jacket	.30	So. Eureka	2.50

N. Y. EXCH. Mar. 11

Name of Comp.	Clg.
Amalgamated	70
Am. Agri. Chem	53
Am.Sm.&Ref.,com	68
Am. Sm. & Ref., pf.	103
Am. Sm. Sec., pf. B	84
Anaconda	36
Batopilas Min	1
BethlehemSteelpf	69
Chino	39
Federal M. & S., pf.	37
Goldfield Con	2
GreatNor.,ore,,ctf.	34
Guggen. Exp	46
Homestake	100
Inspiration Con	16
Miami Copper	23
Nat'nalLead,com.	49
National Lead, pf.	105
Nev. Consol	17
Phelps Dodge	200
Pittsburg Coal, pf.	87
Ray Con	18
Republic I&S,com.	25
Republic I & S, pf.	87
SlossSheffi'd,com.	34
Sloss Sheffield, pf.	91
Tennessee Copper	36
Utah Copper	53
U. S. Steel, com	60
U. S. Steel, pf.	107
Va.Car. Chem., pf.	107

N. Y. CURB Mar. 11

Name of Comp.	Clg.
Barnes King	.97
Beaver Con	.40
Braden Copper	8
B. C. Copper	3
Buffalo Mines	2
Caledonia	‡.40
Con. Ariz. Sm.	3
Davis-Daly	1
Diam'field-Daisy	.05
Ely Con	.14
Florence	.48
Giroux	3
Gold Hill Con	‡
Greene Cananea	8
Greenwater	04
Internat. S. & R.	‡117
Kerr Lake	3
Keystone	‡2
La Rose	2
McKinley-Dar-Sa.	2
Min. Co. of A. new	2
Motherlode Gold	‡.60
Nev. Utah M. & S.	‡ 01
Nipissing Mines	8
Ohio Copper	3
Pacific Sm. & M.	3
Puebla S. & R.	2
South Live Oak	‡2
South Utah M.&S.	3
Standard Oil (Old)	1110
Stand'd Oil of N.J.	352
Stewart	1
Tonopah	5
Tonopah Ex	1
Tonopah Merger	.82
Tri-Bullion	
Tularosa	
Union Mines	‡
United Cop., pfd.	10
Yukon Gold	3

LONDON Mar. 12

Name of Com.	Clg.
Camp Bird	£1 0s 0d
El Oro	0 17 3
Esperanza	1 9 6
Mexico Mines	6 15 0
Oriental Con.	1 9 0
Oroville	0 8 0
Santa Gert'dis	1 6 0
Tomboy	1 7 6

BOSTON EXCH. Mar. 11

Name of Comp.	Clg.
Adventure	3
Ahmeek	290
Algomah	1
Allouez	37
Am. Zinc	29
Ariz. Com., ctfs.	3
Bonanza	‡.40
Boston & Corbin	6
Butte & Balak	2
Calumet & Ariz	63
Calumet & Hecla	464
Centennial	‡15
Cliff	‡1
Copper Range	44
Daly West	3
East Butte	12
Franklin	6
Granby	59
Hancock	17
Hedley Gold	‡30
Helvetia	‡
Indiana	12
Island Cr'k, com.	‡51
Island Cr'k, pfd.	‡86
Isle Royale	24
Keweenaw	2
Lake	16
La Salle	4
Mass	‡5
Michigan	‡1
Mohawk	49
New Arcadian	2
New Idria Quick.	6
North Butte	28
North Lake	‡2
Ojibway	‡23
Old Dominion	48
Osceola	88
Quincy	68
Shannon	11
Shattuck-Ariz	25
Superior	30
Superior & Bost.	3
Tamarack	29
Trinity	4
Tuolumne	2
U. S. Smelting	40
U. S. Smelt'g, pf.	48
Utah Apex	2
Utah Con	9
Victoria	1
Winona	‡2
Wolverine	61
Wyandot	‡1

BOSTON CURB Mar. 11

Name of Comp.	Last
Alaska Gold M.	13
Bingham Mines	4
Boston Ely	.65
Boswyocolo	‡ 01
Butte Central	7
Cactus	06
Calaveras	3
Chief Cons	1
Corbin	.68
Cortez	30
Crown Reserve	3
Eagle & Blue Bell	1
First Nat. Cop.	2
Majestic	42
Mexican Metals	
Moneta Porc	‡ 06
Nevada-Douglas	2
New Baltic	80
Oneco	1
Raven Copper	16
Rhode Island Coal	08
Smokey Dev	1
S. W. Miami	
South Lake	7
Trethewey	.42
United Verde Ext.	68

‡Last quotation.